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MOSSES OF THE INTERIOR HIGHLANDS OF NORTH AMERICA

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Abstract

A manual of the mosses of the Interior Highlands of North America that include diagnostic keys to the families, genera, and species.

The Interior Highlands of North America includes several diverse physiographic regions (Figure 1) that generally coincide with the boundaries of the oak-hickory forest region as outlined by Braun (1950). The northern portion of this region includes two extensive plateaus, the Salem and the Springfield. Upland forest associations include both oak-hickory forests and sugar maple-white oak forests. Along north slopes and in narrow ravines more mesic forests, such as the sugar maple-red oak association, may be present. Along flood plains mature forests are often dominated by sugar maple and bitternut hickory. Local relief is frequently rugged and consequently extensive rock outcrops and bluffs, composed chiefly of limestone and dolomite, are common. On the thin soils of the summits of ridges and drier south-facing slopes, cedar glades and rocky barrens are often encountered. Springs are also a common feature of these plateaus. Some exposures of sandstone may be encountered, particularly along the western border of the Springfield Plateau adjacent to the Prairie Plains and in the eastern part of the Salem Plateau. Within the Salem Plateau there is a residual upland area of rugged relief, the St. Francois Mountains, where crystalline rocks, mainly felsite and granite, are extensively exposed. In such areas open, rocky barrens commonly develop, particularly on the steeper slopes near and on the summits of the ridges. Oak-hickory forests are very well developed in this region.

To the south of the northern plateau region lie the Boston Mountains or Boston Plateau, a peneplained area dissected by numerous narrow, deep ravines, particularly along the Buffalo River drainage system. Sandstone is commonly exposed at the higher elevations, while shale and limestone occur at the lower elevations. On the ridges oak-pine or oak-hickory forests are usually well developed. Narrow ravines and north-facing slopes are frequently occupied by rich,

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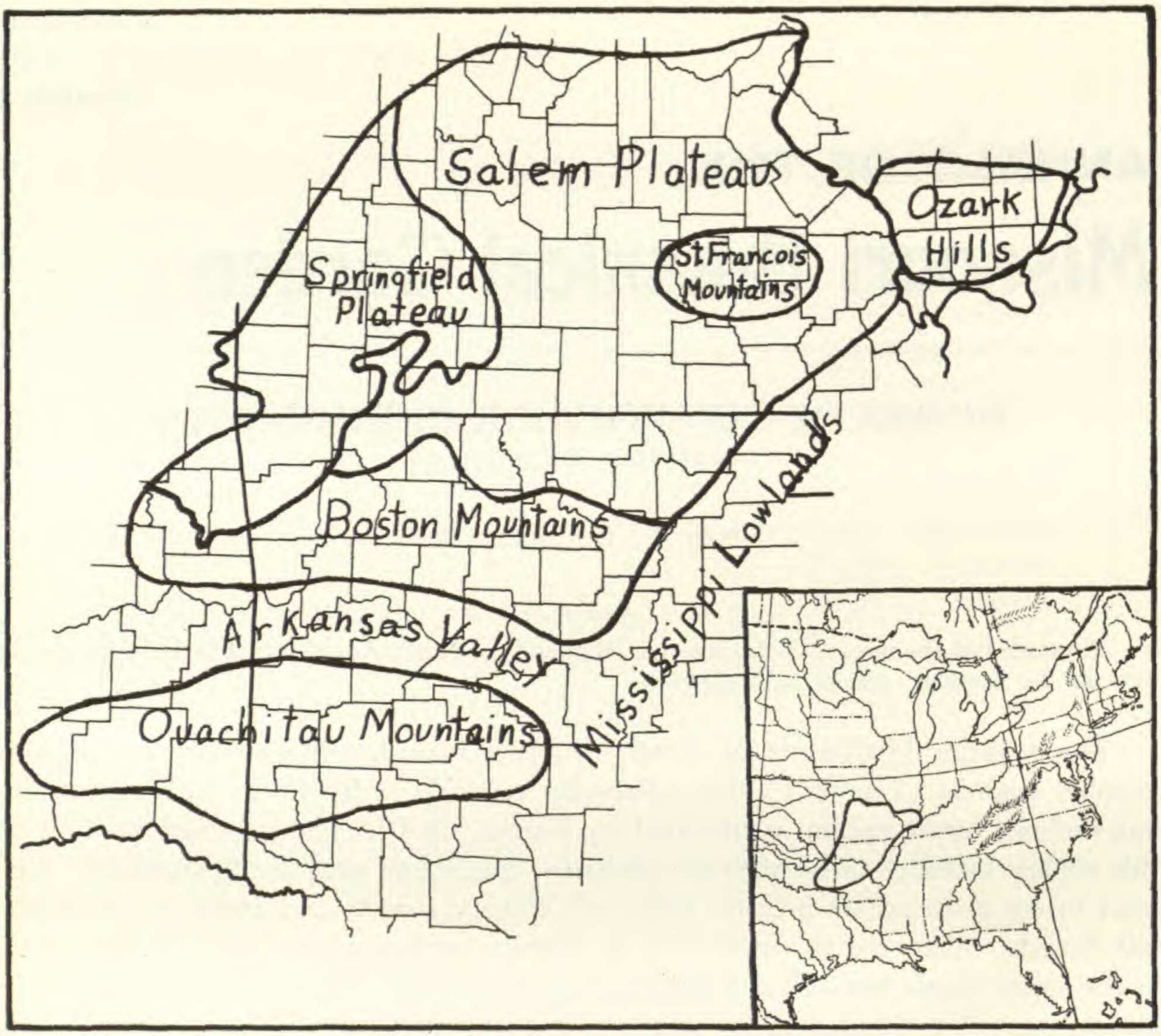

FIGURE 1. Physiographic regions of the Interior Highlands of North America. Inset shows location of the Interior Highlands in Eastern North America. Boundaries approximate.

mesophytic forests that often contain a large percentage of beech and umbrella magnolia.

The southern border of the Interior Highlands is represented by the Ouachita Mountains. The eastern region of the mountains in Arkansas is characterized by a series of low hills separated by narrow, rocky valleys where shale, sandstone, quartzite, and chert are exposed. Pine-oak forests are common, although on deeper soils, oaks and hickories may completely replace pine. The western region of the Ouachita Mountains lies in western Arkansas and southeastern Oklahoma. The valleys separating the mountains are relatively high and broad. Mesophytic forests are common in the ravines which indent the lower and middle slopes. Extensive erosion has exposed shale, sandstone, chert, limestone, and norvaculite.

The Arkansas Valley separates the Boston and Ouachita Mountains. This valley, while of generally low relief, contains numerous synclinal mountains that have the appearance of steep-sided buttes. Most of the slopes are covered with a mesophytic forest. The rocks most commonly exposed are sandstone and shale. On the benches and flat summits, drainage is often poor enough to produce small

Sphagnum bogs. Along the smaller streams of the valley the sandy soils are occupied by forests that include both pine and sweetgum.

The Ozark Hills of southern Illinois contain two basic types of escarpments (Voight & Mohlenbrock, 1964): Those composed of sandstone and extending in an east-west direction, and those composed of limestone running in a north-south direction paralleling the Mississippi River. The forests near the summits of ridges are xerophytic, oak-hickory type, while the forests of ravines and lower slopes are of the mesophytic type. Along ledges and ravines, extensive exposures of sandstone or limestone are common and support a diverse rock ledge vegetation.

In the development of the diagnostic keys and the arrangement of the families no originality is claimed. Previously published treatises, particularly by Grout (1928–1940) and Welch (1957), have been particularly useful although extensive modification was often required. Recent monographs and revisions have also been consulted and are cited wherever appropriate. Nomenclature has been updated so as to be consistent with not only the most recent monographs and revisions, but also in general accord with "A list of the mosses of North America" by Crum, Steere, and Anderson (1965) and "Index Muscorum" (Wijk *et al.*, 1959–1969). The arrangement of the families follows the sequence given by Brotherus (1924–1925).

Descriptions are limited to the families and genera and have been synthesized from only the taxa occurring within the Interior Highlands. Consequently, these descriptions may not always include features of the family or genus in their broadest sense. Synonymy is not meant to be complete, but is included only for those taxa where recent changes may result in some confusion when compared with earlier works. The distribution of each taxon is based primarily on material collected during this study or examined in herbaria of the University of Missouri, the University of Arkansas, the Missouri Botanical Garden, and the Field Museum of Natural History. Literature reports, particularly by Gier (1955*a*) for Missouri, have also been considered. The commonness of each species refers to its distribution in expected habitats (Gleason & Cronquist, 1964) and is, of course, a judgement based upon my own field experience. The terms used to express commonness—rare, uncommon, common, and very common—must be considered purely subjective.

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Voucher specimens of all species collected in this study are deposited in the herbarium of Southwest Missouri State College (SMS). All collection numbers cited are mine unless otherwise indicated.

One final caution on the use of the keys. There is an old adage that "keys are made by people who don't need them for people who can't use them." There is a certain amount of truth in such a statement, but the fact that keys may often function poorly may be due to the complex and dynamic nature of the species being keyed out and that a particular collection may not possess all the stages that make identification relatively sure. Therefore, one should develop the habit, particularly if experience with mosses is limited, of comparing carefully each collection identified with its description and with a herbarium specimen that has been named by someone more experienced with mosses. If such collections are not available, any number of bryologists, including the author, are usually more than willing to examine unidentified or identified collections, provided the specimens are supplied in good condition and with adequate collection data. Ideally, such data should include the type of substrate (soil type, rock type, or species of tree and location on tree) upon which the moss was growing, general habitat of the species, exact location, date of collection, and collector. You should send enough material so that the person identifying the collection may retain a duplicate for his records.

To aid in the use of the keys, a glossary of the more common bryological terms is included in Appendix I. An index to families and genera follows in Appendix II.

Key to the Mosses of the Interior Highlands of North America[2]

1.	Leaves composed of a single layer of two kinds of cells, narrow linear chlorophyllose-cells forming the meshes of a network enclosing large rhomboidal hyaline cells	Sphagnaceae (1)
1.	Leaves not as above	2
2.	Plants large, erect, dendroid (tree-like) in growth form	3
2.	Plants not dendroid	4
3.	Leaves irregularly serrate near apex	*Thamnobryum* (29)
3.	Leaves serrate, often coarsely so, but not irregularly serrate	*Climacium* (25)
4.	Leaves composed almost entirely of costa made up of 2–3 layers of hyaline cells whose walls are perforated with circular pores and enclose a central layer of narrow chlorophyllose cells; plants in cushion-like tufts, whitish green	*Leucobryum* (8)
4.	Plants not as above	5
5.	Plants acrocarpous, generally but not always erect in habit	6
5.	Plants pleurocarpous, generally but not always creeping in habit	12
6.	Leaves in two ranks or if in three ranks, leaves of some branches complanate	Section A
6.	Leaves in three ranks, not appearing complanate	7
7.	Leaves ecostate	Section B
7.	Leaves costate	8
8.	Leaves with lamellae on upper surface of costa	Polytrichaceae (43)
8.	Leaves without lamellae	9
9.	Gemmae bearing structures conspicuous	Section C
9.	Gemmae bearing structures not conspicuous; gemmae, if present, on leaves or in axils of leaves	10
10.	Leaves with hyaline apices or excurrent costae	Section D
10.	Leaves not as above	11
11.	Leaves papillose or mammillose	Section E
11.	Leaves smooth	Section F
12.	Leaves costate	13
12.	Leaves ecostate	Section G
13.	Costa short and double (may be absent in some leaves)	Section H
13.	Costa reaching the middle of the leaf or beyond	14
14.	Leaves not papillose	Section I
14.	Leaves papillose	Section J

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[2] Number in parenthesis is the number of the family or the family in which the taxon may be found.

Section A

Plants acrocarpous: leaves distichous or in three ranks and complanate.

1. Leaves distichous 2
1. Leaves only appearing distichous, in three ranks and complanate .... *Mnium* (17)
 2. Leaves split at base and clasping stem .... *Fissidens* (2)
 2. Leaves not split at base .... *Bryoxiphium* (5)

Section B

Plants acrocarpous (though often with the growth form of a pleurocarp); leaves three-ranked, not complanate, ecostate.

1. Leaf cells smooth .... *Venturiella sinensis* (21)
1. Leaf cells papillose .... *Hedwigia ciliata* (26)

Section C

Plants acrocarpous; leaves three-ranked, costate; gemmae bearing structures conspicuous.

1. Leaves ovate to ovate-lanceolate; many sterile stems bearing a gemmae-bearing cup composed of small leaves; peristome single, composed of 4 teeth .. *Tetraphis pellucida* (15)
1. Leaves long-lanceolate; some stems bearing pseudopodia that are naked or bearing minute leaf-like gemmae in a cluster at upper end; peristome double, teeth 16 .... *Aulacomnium* (18)

Section D

Plants acrocarpous; leaves three-ranked, costate, apices or excurrent costa hyaline; gemmae not present on special structures.

1. Plants dark green, blackish green, or golden green in color 2
1. Plants light green to whitish green in color .... *Bryum argenteum* (16)
 2. Leaves mostly lanceolate-subulate; alar cells inflated .... *Campylopus introflexus* (7)
 2. Leaves not as above 3
3. Leaves obtuse, emarginate to truncate at apex; cells papillose; basal cells hyaline, rectangular to long 5
3. Leaves not possessing the above combination of characters 4
 4. Costa subpercurrent to shortly excurrent; septate brood bodies absent .. *Grimmia* (12)
 4. Costa ending below apex; septate brood bodies present .. *Orthotrichum diaphanum* (23)
5. Plants small, 2–5 mm high; awn smooth .... *Desmatodon plinthobius* (11)
5. Plants larger, 5–15 mm high; awn smooth or serrate; if plants small, growing on trees .... *Tortula* (11)

Section E

Plants acrocarpous; leaves three ranked, costate, apices or excurrent costa not hyaline, cells papillose or mammillose; gemmae not present on special structures.

1. Plants minute, usually growing in wet, sandy sites .... *Ephemerum* (13)
1. Plants small to large 2
 2. Leaves strongly serrate, bordered from base to apex by hyaline, elongated cells; the inner cells of sheathing base, thin-walled and hyaline .... *Syrrhopodon texanus* (9)
 2. Leaves not as above 3
3. Hyaline cells extending up the margin of the leaf base further than along the costa, forming a V; leaves oblong-lanceolate to broadly lanceolate-acuminate 4
3. Hyaline cells absent along the leaf base, or if present, only faintly showing a V-shaped arrangement; leaves narrowly lanceolate to linear-lanceolate 5
 4. Margins of leaf entire; basal hyaline cells extending to the costa .. *Tortella humilis* (11)
 4. Margins of leaf minutely serrate near apex; basal hyaline cells not extending to the costa .... *Pleurochaete squarrosa* (11)
5. Leaves bordered with bands of 2–3 rows of light-colored cells .... *Desmatodon* (11)
5. Leaves not so bordered 6
 6. Papillae formed by projecting end walls of cells, evident at least on lower cells if not on upper cells .... BARTRAMIACEAE (19)
 6. Papillae centered over the lumen of all cells 7

7. Leaves with a hyaline or yellowish basal sheath; margins strongly serrate from sheathing base to apex ..... *Timmia* (20)
7. Leaves not as above 8
   8. Apices of leaves channelled, acuminate or acute; costa percurrent to short-excurrent; alar cells usually inflated ..... *Dicranum* (7)
   8. Leaves not as above 9
9. Costa excurrent 10
9. Costa percurrent or ending below apex 15
   10. Costa excurrent as a short, yellow or pellucid, rounded mucro; cells strongly papillose on back; leaves oblong to lingulate from ovate base, apices usually obtuse ..... *Barbula* (11)
   10. Leaves not as above 11
11. Costa excurrent into a long awn 12
11. Costa not excurrent as a long awn, leaves often ending in a small, short, sharp, nearly hyaline to hyaline point; margins plane or strongly involute above ..... POTTIACEAE (11)
   12. Awn smooth or nearly so 13
   12. Awn spinose or sharply serrate 14
13. Leaves obovate, lingulate or panduriform; apices rounded or truncate; propagula often present at apex of stem, in axils of upper leaves, or on upper surface of leaves ..... *Tortula* (11)
13. Leaves ovate to oblong-lanceolate; apices acuminate; propagula absent ..... *Phascum* (11)
   14. Plants small; leaves nearly linear, subulate-lanceolate; apices mostly acuminate or subulate ..... *Bruchia* (7)
   14. Plants moderately large; leaves oblong-spatulate; apices obtuse or truncate ..... *Tortula* (11)
15. Costa ending below the apex 16
15. Costa ending in the apex or excurrent 18
   16. Leaves lingulate; apices obtuse; capsule oblique-pointed and immersed in hair-like perichaetial leaves ..... *Diphyscium* (42)
   16. Leaves and capsule not as above 17
17. Leaves elongate-ovate; apices usually obtuse and apiculate; margins coarsely toothed in upper ½–⅔ ..... *Aulacomnium* (18)
17. Leaves lanceolate to lingulate; apices subacute, acuminate, or obtuse ..... POTTIACEAE (11)
   18. Leaves lingulate, subspatulate; apices obtuse; margins plane and coarsely serrate above; propagula present in axils of upper leaves; plants usually growing on rocks in or along streams ..... *Hyophila involuta* (11)
   18. Plants not as above 19
19. Leaves lanceolate to ovate-lanceolate or oblong-lanceolate 20
19. Leaves oblong-lingulate to lingulate ..... *Desmatodon* (11)
   20. Costa with elongated cells on upper surface; capsules exserted ..... *Barbula* (11)
   20. Costa without elongated cells on upper surface; capsules immersed to emergent ..... ORTHOTRICHACEAE (23)

SECTION F

Plants acrocarpous; leaves three-ranked, costate, apices or excurrent costae not hyaline, cells smooth; gemmae not present on special structures.

1. Leaves distinctly bordered, at least in part, by 1 to several rows of narrow, hyaline cells 16
1. Leaves not distinctly bordered by narrow, hyaline cells 2
   2. Alar cells clearly differentiated, usually enlarged and inflated; leaves broadly to narrowly lanceolate ..... DICRANACEAE (7)
   2. Leaves not as above 3
3. Plants dark green, brownish green, or blackish green 4
3. Plants green, light green, whitish green, or reddish green 7
   4. Plants minute, leaves subulate, growing on limestone ..... *Seligeria* (6)
   4. Plants not as above 5
5. Plants with primary stems prostrate and bearing numerous erect, crowded, and densely foliate branches ..... *Drummondia* (23)
5. Plants not as above 6

6. Leaves crisped when dry, linear from a lanceolate base; margins plane, entire or serrate above; apices obtuse to almost blunt ..... *Ptychomitrium* (22)
6. Leaves usually imbricate when dry, ovate-lanceolate to linear-lanceolate; margins plane to narrowly or strongly recurved; apices muticous to subobtuse ..... *Grimmia* (12)
7. Leaves crispate when dry 8
7. Leaves not crispate when dry 9
8. Plants very small, stems usually less than 1 mm long; calyptra mitrate; seta arcuate ..... *Campylostelium saxicolum* (22)
8. Plants larger, stems 2–10 mm long; calyptra cucullate; seta not distinctly arcuate ..... DICRANACEAE (7)
9. Leaves secund, frequently falcate ..... DICRANACEAE (7)
9. Leaves not secund or falcate 10
10. Plants small, stems usually averaging less than 4 mm in height 11
10. Plants larger, stems usually averaging greater than 5 mm in height 12
11. Capsules immersed, globular, dehiscing at equatorial line ..... *Aphanorhegma* (14)
11. Capsules not as above 15
12. Plants densely tufted; leaves oval, ovate, ovate-lanceolate to narrowly lanceolate 13
12. Plants loosely gregarious; leaves oblong-lanceolate, obovate-lanceolate to obovate ..... FUNARIACEAE (14)
13. Median leaf-cells thick-walled, quadrate to hexagonal or roundish-quadrate, 6–10 μ in diameter 14
13. Median leaf-cells thin- or thick-walled, prosenchymatous, rhomboidal-hexagonal to linear, 14–100 μ in longest direction ..... BRYACEAE (16)
14. Margins entire; median leaf-cells rounded quadrate ..... *Didymodon trifarius* (11)
14. Margins denticulate to serrate near apex; median leaf-cells quadrate, hexagonal-quadrate or irregular ..... *Ceratodon purpureus* (4)
15. Capsules ovoid, cylindric, or pyriform 19
15. Capsules sphaerical, indehiscent and immersed 18
16. Plants with large terminal rosette of leaves ..... *Rhodobryum roseum* (16)
16. Plants not as above 17
17. Median leaf-cells parenchymatous, mostly hexagonal or rounded ..... *Mnium* (17)
17. Median leaf-cells prosenchymatous, rhomboidal, rhomboid-hexagonal to linear ..... BRYACEAE (16)
18. Leaves lanceolate-subulate; spores few (*ca.* 24), large, 145–174 μ in diameter, angular or tetrahedral, deep yellow or orange ..... *Archidium ohioense* (3)
18. Leaves broadly ovate; spores smaller, 40–50 μ in diameter ..... *Acaulon muticum* var. *rufescens* (11)
19. Capsules ovoid or cylindric 20
19. Capsules pyriform ..... *Bruchia* (7)
20. Plants minute; capsules inoperculate ..... *Ephemerum* (13)
20. Plants larger; capsules operculate ..... DITRICHACEAE (4)

SECTION G

Plants pleurocarpous; leaves three-ranked, ecostate.

1. Plants large and normally aquatic ..... *Fontinalis* (24)
1. Plants small or large, not aquatic 2
2. Leaves papillose 3
2. Leaves smooth 4
3. Plants slender; leaves ovate to ovate-lanceolate; alar cells abruptly quadrate to short rectangular ..... *Schwetschkeopsis fabronia* (32)
3. Plants more or less robust; leaves ovate-elliptical; alar cells roundish-quadrate; secondary stems sparingly branched, branches curved outward and upward from substratum ..... *Leucodon* (28)
4. Branches and stems complanate-foliate at least in part 5
4. Branches and stems not at all complanate-foliate 6
5. Leaves oblong-ovate, soft, thin, light-green; median leaf cells 50–60 μ wide ..... *Hookeria acutifolia* (30)
5. Leaves ovate-lanceolate, lingulate, or cultriform, green to yellow-green or brownish green; leaf cells 10 μ or less wide ..... NECKERACEAE (29)

6. Secondary stems not to sparingly branched, branches curved outward and upward from substratum; leaves ovate to ovate-lanceolate; alar cells numerous, roundish-quadrate .... *Leucodon* (28)
6. Secondary stems and leaves not as above 7
7. Leaves squarrose-spreading, triangular-cordate .... *Campylium* (35)
7. Leaves not both squarrose-spreading and triangular-cordate 8
8. Plants very small; leaves to 0.6 mm long; alar cells not inflated .... *Platydictya* (35)
8. Plants larger; leaves to 2.5 mm long; alar cells inflated .... SEMATOPHYLLACEAE (39)

SECTION H

Plants pleurocarpous; leaves three-ranked, costa short and double.

1. Leaves papillose 14
1. Leaves not papillose 2
2. Branches complanate-foliate 3
2. Branches not complanate-foliate 5
3. Leaves falcate-secund .... HYPNACEAE (40)
3. Leaves not falcate-secund 4
4. Numerous quadrate alar cells extending 8–10 rows up margin .... *Entodon* (37)
4. Alar cells not as above .... PLAGIOTHECIACEAE (38)
5. Foliated stems and branches julaceous 6
5. Foliated stems and branches not julaceous 10
6. Stems conspicuously red; leaves broadly ovate-elliptic; alar cells enlarged and somewhat inflated .... *Pleurozium* (37)
6. Plants not as above 7
7. Secondary stems curved outward and upward from substratum; apices of leaves abruptly short-acuminate; alar cells numerous, roundish quadrate .... *Leucodon* (28)
7. Plants not as above 8
8. Quadrate alar cells numerous, extending 10–20 rows along the margin .... *Entodon* (37)
8. Alar cells not as above 9
9. Alar cells composed of 3–8 conspicuously large, inflated, hyaline or colored cells .... *Sematophyllum* (39)
9. Alar cells not as above .... PLAGIOTHECIACEAE (38)
10. Tips of shoot frequently crowded with bud-like axillary gemmae; one inflated cell at extreme basal angle of leaf .... *Platygyrium* (40)
10. Plants not as above 11
11. Branches erect; leaves ovate to oblong-ovate, abruptly and broadly short-acuminate, concave; margins entire; alar cells numerous and quadrate or transversely elongate and extending upward ⅓ length of margin .... *Homomallium adnatum* (40)
11. Plants not as above 12
12. Secondary stems numerous, abundantly subpinnately branched, often bending outward and upward from substratum .... *Forsstroemia* (27)
12. Secondary stems not as above 13
13. Alar cells distinctly enlarged .... SEMATOPHYLLACEAE (39)
13. Alar cells numerous, quadrate .... *Pylaisiella* (40)
14. Plants light to bluish green .... *Myurella sibirica* (31)
14. Plants green to dark green .... *Pterigynandrum filiforme* (37)

SECTION I

Plants pleurocarpous; leaves three-ranked, costa single or double and reaching the middle of the leaf or beyond, cells not papillose.

1. Plants dendroid from creeping stems 2
1. Plants not dendroid 3
2. Leaves irregularly serrate near apex .... *Thamnobryum* (29)
2. Leaves serrate, often coarsely so, but not irregularly serrate .... *Climacium* (25)
3. Plants aquatic to subaquatic; leaves carinate-conduplicate .... FONTINALACEAE (24)
3. Plants not aquatic; if aquatic, not carinate-conduplicate 4
4. Plants glossy, golden yellow to brownish yellow; branches turgid, terete-foliate, julaceous; branch leaves very concave, ovate, acumination of rounded apices twisted ½ turn .... *Bryoandersonia* (36)
4. Plants not as above 5

5. Plants complanate-foliate; leaves oblong-cultriform, rounded obtuse .... NECKERACEAE (29)
5. Plants not as above 6
    6. Plants possessing conspicuous paraphyllia .... *Cratoneuron* (35)
    6. Paraphyllia absent or inconspicuous 7
7. Branches and stems falcate-secund; leaves with distinct, hyaline, enlarged and inflated alar cells that form distinct auricles .... *Drepanocladus* (35)
7. Plants not as above 8
    8. Leaves with a distinct border of elongated, thick-walled cells .... *Sciaromium* (35)
    8. Leaves not as above 9
9. Leaves squarrose to erect-spreading .... *Campylium* (35)
9. Leaves not as above 10
    10. Plants small and slender, in soft, thin mats; quadrate alar cells filling entire base and extending 12–20 rows up margin; margins entire to laciniate-dentate or serrate-dentate .... *Fabronia* (32)
    10. Plants not as above 11
11. Plants slender; quadrate basal cells numerous, distinctly different in shape from median leaf-cells 12
11. Plants not both slender and with numerous quadrate basal cells that differ markedly from median leaf cells 13
    12. Leaves distinctly serrate; costa of branch leaves usually reaching middle of leaf or beyond .... BRACHYTHECIACEAE (36)
    12. Leaves entire to obscurely serrulate .... *Clasmatodon* (32)
13. Branch leaves ovate-lanceolate; median leaf-cells rhombic-hexagonal; alar cells few, thin-walled, quadrate to rectangular; capsule erect, strongly contracted beneath mouth when dry .... *Anacamptodon* (32)
13. Plants not as above 14
    14. Median leaf-cells short, rounded-ovate to isodiametric; if long, alar cells very numerous, rounded-quadrate to transversely oblong and capsule on a short seta .... CRYPHAECEAE (27)
    14. Median leaf-cells long; alar cells not as above 15
15. Leaves ovate-lanceolate or ovate, apices long and slenderly acuminate, usually not plicate; margins entire to slightly serrulate; costa reaching middle of leaf to percurrent or excurrent; median leaf-cells oblong-hexagonal, rhomboidal, to linear, 5–15 : 1; capsule curved and inclined, strongly contracted beneath mouth when dry .... AMBLYSTEGIACEAE (35)
15. Leaves ovate-lanceolate, ovate, ovate-cordate to triangular-cordate, often plicate; margins serrate to serrulate; costa usually ending near middle of leaf in a dorsal spine; median leaf-cells linear, linear-flexuose, oblong-rhomboidal to elongate-rhomboidal, 5–12 : 1; capsule erect to inclined, symmetrical to asymmetrical, not strongly contracted beneath mouth when dry .... BRACHYTHECEACAE (36)

SECTION J

Plants pleurocarpous; leaves three-ranked, costa reaching middle of leaf or beyond, cells papillose.

1. Costa long and double .... *Rhytidiadelphus triquetrus* (41)
1. Costa single 2
    2. Plants robust; leaves secund and strongly rugose; papillae dorsal, extending from angle of cell and strongly directed forward .... *Rhytidium rugosum* (41)
    2. Plants not as above 3
3. Leaves papillose because of thickened cell angles 4
3. Papillae developed over lumen of cells 5
    4. Plants slender, julaceous; cells strongly papillose .... *Pterygynandrum filiforme* (37)
    4. Plants not as above; leaves of stem loosely imbricate .... *Bryhnia* (36)
5. Plants glaucous-green, branches julaceous .... THELIACEAE (31)
5. Plants not as above 6
    6. Apex of leaf hyaline; costa ending near middle of leaf .... *Lindbergia brachyptera* (33)
    6. Apex of leaf not hyaline; if hyaline, costa ending near apex 7
7. Paraphyllia inconspicuous or entirely absent 8

7. Paraphyllia numerous, often branching .... THUIDIACEAE (34)
 8. Capsules usually numerous, immersed in perichaetial leaves; secondary stems sparingly branched; costa protruding on dorsal side of leaf .... *Cryphaea* (27)
 8. Plants not as above 9
9. Leaf bases not clasping the stem .... *Leskea* (33)
9. Leaf bases subclasping to clasping .... THUIDIACEAE (34)

1. SPHAGNACEAE

1. *Sphagnum* L.

The following treatment is adapted from a monograph by Andrews (1913).

Plants primarily of bogs, wet rock ledges and sandy creek banks, erect, whitish green to bright green, often tinged with purple, pink, red, or brown, extensively branching in fascicles disposed spirally about stem, near apex branches often densely crowded; stems without central strand, central portion composed of thin-walled parenchymatous cells, passing gradually into thick-walled, pigmented prosenchymatous cells, these latter cells enclosed by one or more layers of thin-walled parenchymatous cortical cells that may be dimorphic and porose, and have spiral fibril-bands reinforcing walls inwardly; leaves of stems and branches of two kinds of cells, narrow, linear chlorophyllose-cells forming the meshes of a network enclosing large rhomboidal hyaline cells, the latter being porose and with their walls reinforced inwardly by ring-shaped or spiral fibril-bands, pores round to elliptic in shape; sporophytes exserted on a pseudopodium; seta short; capsule globose, dark brown to black; operculum smooth; annulus and peristome absent.

a. Cortical cells of stems and branches reinforced by spiral fibril-bands .... b
a. Cortical cells of stems and branches without spiral fibril-bands c
 b. Chlorophyllose-cells of branch leaves usually isosceles-triangular in section .... 1. S. *palustre*
 b. Chlorophyllose-cells of branch leaves equilateral-triangular in section .... 2. S. *imbricatum*
c. Cortical cells of branches uniform, each with a pore at upper end; chlorophyllose-cells of branch leaves included .... 3. S. *compactum*
c. Cortical cells of branches dimorphic, the large retort-cells with a neck and a pore in the axils of leaves; chlorophyllose-cells of branch leaves not completely included .... d
 d. Chlorophyllose-cells of branch leaves exposed exclusively or more broadly on outer surface .... e
 d. Chlorophyllose-cells of branch leaves equally exposed on both surfaces or exposed exclusively or more broadly on inner surface .... f
e. Cortical cells of stem small and thick-walled .... 4. S. *recurvum*
e. Cortical cells of stem large, thin-walled, in 1–3 layers .... 5. S. *cuspidatum*
 f. Chlorophyllose-cells of branch leaves equally exposed on both surfaces .... 6. S. *subsecundum*
 f. Chlorophyllose-cells of branch leaves exposed exclusively or more broadly on inner surface .... g
g. The free convexity on the outer surface of hyaline cells of stem leaves mostly less than ½ their diameter .... 7a. *Sphagnum capillaceum* var. *capillaceum*
g. The free convexity on the outer surface of hyaline cells of stem leaves usually more than ½ their diameter .... 7b. S. *capillaceum* var. *tenerum*

1. *Sphagnum palustre* L.

Rare, Boston and Ouachita Mtns., Salem and Springfield Plateaus; on sandy soil, edges of streams and creeks.

2. *Sphagnum imbricatum* Hornsch. *ex* Russ. var. *imbricatum*

Rare, Ozark Hills; around seepage areas of springs.

3. *Sphagnum compactum* Lam. & DC.

Uncommon, Boston and Ouachita Mtns., Ozark Hills, eastern Salem Plateau; on moist sandstone ledges of bluffs.

4. *Sphagnum recurvum* P. Beauv.

a. Branch leaves undulate .... 4a. S. *recurvum* var. *recurvum*
a. Branch leaves hardly undulate because of reduced size .... 4b. S. *recurvum* var. *tenue*

4a. *Sphagnum recurvum* var. *recurvum*

Uncommon, Ouachita Mtns.; on sandy moist soil at bases of bluffs.

4b. *Sphagnum recurvum* var. *tenue* Klinggr.

Rare, western Salem Plateau; on moist sandy soil along narrow gully.

5. *Sphagnum cuspidatum* Ehrh. *ex* Hoffm. var. *cuspidatum*

Rare, Ouachita Mtns., Ozark Hills, Prairie Plains; in moist areas beneath sandstone ledges, bluffs, along creeks, and in strip mine pits (Waller & Bass, 1967).

6. *Sphagnum subsecundum* Nees *ex* Strum

Common, Boston and Ouachita Mtns., Salem Plateau; on soil, edges of creeks and streams.

7a. *Sphagnum capillaceum* (Weiss) Schrank var. *capillaceum*

Reported from Boston Mtns., in Franklin County, Arkansas, by Wittlake (1950).

7b. *Sphagnum capillaceum* var. *tenerum* (Sull. & Lesq. *ex* Sull.) Crum (1971)

Rare, Ozark Hills, eastern Salem Plateau; on moist shaded sandy soil of slopes and rock ledges.

2. FISSIDENTACEAE

Members of this family are easily recognized by two features. First, leaves are arranged in two vertical rows in a single plane (distichous) and, second, each leaf consists of a "boat-like" portion (the vaginant or sheathing laminae), which clasps the stem, a dorsal (lower) lamina, and a terminal (apical) lamina. Both the dorsal and apical laminae may be absent in dwarf male plants. Only *Bryoxiphium norvegicum* has a similar arrangement of leaves, but this species is bulb-like at its base, whereas members of the Fissidentaceae are not.

1. *Fissidens* Hedw.

a. Leaves rigid, opaque, several cell layers in thickness .... 15. *F. grandifrons*

a. Plants not as above .... b

b. Plants aquatic; apical lamina 2–3 times as long as the vaginant lamina .... 16. *F. fontanus*

b. Plants not aquatic; apical lamina as long as the vaginant lamina or shorter; if longer, not 2–3 times c

c. Leaves obtuse, entire .... 4. *F. obtusifolius*

c. Leaves acute to acuminate .... d

d. Leaves distinctly bordered with a row of elongate cells that extends to the apex or subapical region of the apical and dorsal laminae .... e

d. Leaves not distinctly bordered; if bordered, the border confined to the vaginant lamina or border not composed of elongated cells .... g

e. Leaves widely spreading, forming an angle of 45° or more with the stem .... 3. *F. viridulus*

e. Leaves not widely spreading, forming an angle of 30–45° with the stem .... f

f. Leaf cells 6–10.0 μ in diameter, obscure; leaves narrowly lanceolate to oblong lanceolate; apex acute to acuminate .... 1. *F. minutulus*

f. Leaf cells 10–13 μ in diameter, pellucid; leaves lanceolate to ligulate; apex acute to obtuse .... 2. *F. pusillus*

g. Leaves bordered by elongated cells, border confined to the vaginant laminae, at times indistinct, absent or confined to perichaetial leaves, often intramarginal; if absent plants less than 5 mm tall[3] .... h

g. Leaves not bordered by elongated cells, plants 5 mm or more tall .... k

h. Leaf cell papillose i

h. Leaf cells smooth or bulging .... j

i. Costa ending 2–several cells below apex .... 8. *F. garberi*

i. Costa percurrent to excurrent .... 7. *F. ravenelii*

j. Leaf margins entire except near apex .... 5. *F. exiguus*

j. Leaf margins sub-entire to irregularly crenate; margins of the vaginant laminae strongly crenate-dentate .... 6. *F. exilis*

k. Leaves coarsely and irregularly crenulate-serrate l

k. Leaves finely and evenly crenulate by projecting cell angles .... n

l. Costa ending several cells below apex and covered with low mammillose cells .... 14. *F. subbasilaris*

l. Costa percurrent and not covered with mammillose cells .... m

m. Leaf cells obscure, enlarged and elevated tumid cells appearing singly or in groups in surface view of apical lamina; leaf cells 7–9 μ in diameter; border of paler or thicker-walled cells distinct; leaves crowded on stem, rolled inward from tips when dry .... 11. *F. cristatus*

m. Leaf cells clear, tumid cells absent or few; leaf cells 13–16 μ in diameter; border of differentiated cells often indistinct; leaves distant on stem, curving underneath stem and with upper ¼ wrinkled and distorted when dry .... 13. *F. adianthoides*

n. Costa ending several cells below apex; sporophyte terminal .... 10. *F. osmundioides*

n. Costa percurrent to shortly excurrent; sporophyte lateral .... o

o. Costa stout, usually filling apiculus, short-excurrent; cells of apical lamina conically papillose or mammillose .... 9. *F. taxifolius*

o. Costa slender, not filling apiculus, percurrent; cells of apical lamina pluripapillose .... 10. *F. bushii*

1. *Fissidens minutulus* Sull. var. *minutulus*

Common throughout Interior Highlands; often abundant on moist, shaded rocks.

The bordered groups (Sections *Bryoidium* and *Semilimbidium*) of this genus are not well understood. Many workers, notably Crum (1964), consider not only *Fissidens minutulus* but *F. viridulus* var. *viridulus* and *F. exiguus* to be forms of

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[3] Occasionally smaller forms of *Fissidens taxifolius* or *F. osmundioides* may key out here.

F. bryoides Hedw. Other workers do not even recognize *F. pusillus*. Grout (1936) considers it a synonym of *F. minutulus*, and Wijk and Margadant (1960) consider it a subspecies of *F. minutulus*. However, this work follows the treatment by Pursell (1957) that recognizes not only *F. minutulus*, but also *F. pusillus* and *F. viridulus* var. *viridulus*. Since *F. exiguus* also seems distinct in Ozark material, it is also retained. For the present, such an arrangement best expresses the situation.

2. *Fissidens pusillus* (Wils.) Mild.

Fissidens minutulus Sull. subsp. *pusillus* (Wils.) Wijk & Marg.

Uncommon, Boston Mtns., Prairie Plains, Salem and Springfield Plateaus; on shaded rocks that are usually in or near creeks and streams.

This species is undoubtedly closely related to the previous one. In *Fissidens minutulus*, leaves are narrowly lanceolate to oblong-lanceolate with an acute apex, and the cells of the apical lamina are small (6–10 μ in diameter) and consequently appear obscure. In contrast, the leaves of *F. pusillus* are broader, lanceolate to ligulate with an acute to obtuse apex; the cells of the apical lamina are relatively large (10–13 μ in diameter) and appear pellucid.

3. *Fissidens viridulus* (Sw.) Wahlenb. var. *viridulus*

Fissidens bryoides Hedw. var. *viridulus* (Sw.) Kindb.

Common throughout the Interior Highlands; on rocks and soil, particularly of moist and well shaded forests.

In addition to the character mentioned in the key, this species may be recognized in the field by its unusually distinct margins, relatively robust size (stems 3–8 mm in length), and the lustrous dark to light green color of the plants.

4. *Fissidens obtusifolius* Wils. var. *obtusifolius*

Common, Boston Mtns., Prairie Plains, Salem and Springfield Plateaus; on limestone or sandstone rocks in or along the edge of creeks and streams. Locally, this species may be very abundant.

A species easily recognized in the field because of its obtuse leaves and the pale green, at times almost glaucous, color of the colonies.

5. *Fissidens exiguus* Sull. subsp. *exiguus*

Uncommon, Boston Mtns., Prairie Plains, Salem and Springfield Plateaus; on rocks rarely soil along banks of creeks and streams.

This species is of doubtful validity. As noted previously, Crum (1964) considers it to be a form of *Fissidens minutulus*.

6. *Fissidens exilis* Hedw.

Reported from northern Salem Plateau by Gier (1955*a*:34) from collections made by N. L. T. Nelson. The location of Nelson's collection is unknown.

7. *Fissidens ravenelii* Sull.

Uncommon, Boston and Ouachita Mtns., Ozark Hills, Salem and Springfield Plateaus; restricted to moist shaded crevices of sandstone.

Superficially this species resembles *Fissidens garberi*; the presence of a percurrent to excurrent costa in *F. ravenelii*, however, is usually a reliable distinguishing character.

8. *Fissidens garberi* Lesq. & James

Common, Boston and Ouachita Mtns., Prairie Plains, Salem Plateau; on sandy dolomite and sandstone along streams and creeks. Occasionally plants occur deep within rock crevices.

The presence of this species in the Interior Highlands was first noted by Ireland from a collection made in Cedar County, Missouri (see Redfearn, 1961).

The border of the vaginant lamina is often difficult to demonstrate. Breen (1963:7) notes that the border is usually restricted to the uppermost pair of leaves (perichaetial). In the Interior Highlands, the separation of this species from *Fissidens ravenelii* is not always easy. However, in *F. garberi* the costa in most leaves is not percurrent and ceases 2–several cells below the apex.

Florschütz (1964) places both this species and *Fissidens ravenelii* in synonymy under *F. guianensis* Mont. Considering the difficulty encountered in separating *F. ravenelii* and *F. garberi* in the Interior Highlands, he may be correct.

9. *Fissidens taxifolius* Hedw. var. *taxifolius*

Very common throughout the Interior Highlands; on shaded soil, rock ledges and crevices, bases of trees, and decaying wood.

10. *Fissidens osmundioides* Hedw. var. *osmundioides*

Uncommon, Boston and Ouachita Mtns., Ozark Hills, Salem Plateau; on shaded sandstone ledges and soil banks along creeks and streams.

Sterile forms of this species may be confused with *Fissidens taxifolius* or poorly developed forms of *F. cristatus*. However, a costa which distinctly ends 2 to several cells below the apex will serve to separate it from *F. taxifolius*, and the even and finely serrulate to crenulate margins will distinguish it from *F. cristatus*.

11. *Fissidens cristatus* Wils. *ex* Mitt. var. *cristatus*

Very common throughout the Interior Highlands; occurring in nearly every conceivable type of habitat—soil, limestone, sandstone, granite and felsite rocks, trees, decaying wood.

This species may be confused with the next, however the distinctions noted in the key have been demonstrated by Anderson and Bryan (1956) to be quite reliable.

12. *Fissidens bushii* (Card. & Thér.) Card. & Thér.

Uncommon, Boston and Ouachita Mtns., Ozark Hills, Salem and Springfield Plateaus; on shaded soil and decaying wood.

13. *Fissidens adianthoides* Hedw. var. *adianthoides*

Uncommon, Boston and Ouachita Mtns., Salem and Springfield Plateaus; on moist shaded soil along creeks and streams, occasionally on rocks along seepage areas.

14. *Fissidens subbasilaris* Hedw.

Common throughout the Interior Highlands; on moist soil, shaded rocks, bases and trunks of trees, and decaying wood.

15. *Fissidens grandifrons* Brid. var. *grandifrons*

Uncommon, Boston Mtns., Salem Plateau, St. Francois Mtns.; on submerged stones, usually near the emergence of swiftly flowing springs.

The stiff, dark leaves are very distinctive. It is not unusual for this species to be locally very abundant. At Big Springs in Carter County, Missouri, rocks near the spring outlet are densely covered with this species, a condition not unusual at other large springs.

16. *Fissidens fontanus* (B. Pyl.) Steud.

Fissidens debilis Schwaegr.

Common throughout Interior Highlands; on stones, roots, and branches in streams and creeks.

3. ARCHIDIACEAE

1. *Archidium* Brid.

Plants erect, small, terrestrial; leaves narrow, lanceolate to subulate; margins entire to serrulate; costa excurrent to ending in a subulate awn; cells smooth; perichaetial leaves long-pointed, to 2.25 mm, 3–4 times as long as the capsule; capsule cleistocarpous, sessile, ovoid, thin walled and containing about 12–24 very large (120–160 μ in diameter), yellow to orange spores clearly visible through the thin wall of the capsule; oil bodies conspicuous in spores.

Sterile plants of this genus are difficult, if not impossible, to separate from *Pleuridium* and *Bruchia*. When fertile, the ovoid, sessile, cleistocarpous capsule containing the largest spores found in the mosses will at once separate this genus from all other mosses in our area.

1. *Archidium ohioense* Schimp. *ex* C. Müll.

Rare, known only on the Springfield Plateau from Dade County, Missouri, *ca.* 1 mile W of Bona along Highway H, SW ¼ Sect. 33, R. 25 W., T. 33 N. On sandy soil of open oak forest.

Probably more common but overlooked when sterile because of its small size and the tendency of plants to be half buried in sand.

4. DITRICHACEAE

Plants dark green to yellow-green, erect, small to moderate in size, usually less than 2 cm tall, gregarious to scattered; leaves lanceolate to lanceolate-subulate from a broader base, not distinctly secund, occasionally contorted when dry; costa percurrent to excurrent and occupying the larger part of the awn; leaf-cells smooth to faintly papillose; alar cells not inflated; capsule immersed to exserted on a long seta, spherical, ovoid, or cylindrical, cleistocarpous or dehiscing regularly; peristome, when present, of 16 teeth split to base or nearly so into 32 filiform divisions.

Three genera of this family are represented in the Interior Highlands. When sterile, identification is difficult and dubious. Consequently the following key is based primarly upon sporophytic characters. This is not to say that generic identification of sterile material is not possible in some cases, but should only be undertaken after complete familiarity with fertile plants.

a. Plants small, usually less than 2 mm high; capsule cleistocarpous; peristome absent .... 1. *Pleuridium*
a. Plants usually larger; capsule dehiscing regularly; peristome present .... b
  b. Leaves ovate-lanceolate to narrowly-lanceolate, green to dark-green, often contorted; margins conspicuously revolute, rarely to apex; upper leaf-cells quadrate to short-rectangular .... 2. *Ceratodon*
  b. Leaves lanceolate-subulate, light green to yellowish green, often slightly secund; median leaf-cells rectangular to linear .... 3. *Ditrichum*

1. *Pleuridium* Brid.

Plants small, green to yellowish green; leaves erect-spreading, mucronate to subulate from an ovate to lanceolate base; margins entire to minutely serrate; costa sub-percurrent, to percurrent, to excurrent; cells mostly elongate-rectangular, smooth; alar cells not enlarged or inflated; capsule erect on short seta, ovoid to subglobose, apiculate, immersed in perichaetial leaves; peristome absent.

a. Broad base of perichaetial leaves short, scarcely reaching the base of capsule .... 1. *P. subulatum*
a. Broad base of perichaetial leaves longer, nearly reaching the end of the capsule .... 2. *P. acuminatum*

1. *Pleuridium subulatum* (Hedw.) Rabenh.

Common, Arkansas Valley, Boston Mtns., Mississippi Valley, Ozark Hills, Salem and Springfield Plateaus; on soil of pastures, fields, and rocky ridges. Capsules present from early spring to summer.

Because of the small size of this species, it is likely to be overlooked; however, when fruiting it is easily identified by its yellow-green appearance, subulate leaves, and immersed, small, subglobose, cleistocarpous capsule. *Pleuridium subulatum* is difficult to separate from *P. acuminatum*. In addition to the distinctions used in the key to the species that have been suggested by Nyholm (1954), Bryan (1956) reports cytological differences: *P. subulatum* is a diploid ($n = 13$) and *P. acuminatum* is a tetraploid ($n = 26$).

2. *Pleuridium acuminatum* Lindb.

Common, Prairie Plains, Salem Plateau; on moist soil of open forests, in fields and pastures.

Like the preceding species, this one is frequently overlooked, but when fruiting may be separated from *P. subulatum* by the characters noted above.

2. *Ceratodon* Brid.

1. *Ceratodon purpureus* (Hedw.) Brid.

Caespitose plants, green when young, often becoming reddish when old; leaves ovate-lanceolate to narrowly lanceolate, twisted and contorted when dry; margins revolute from apex nearly to base, usually serrate above; median leaf-cells rectangular to square, weakly collenchymatous; seta dark red to purplish, 1–2.5 cm long; capsule oblong, deeply grooved, more or less curved and unsymmetric; peristome with 16 bifid, dark red teeth.

Common, Arkansas Valley, Boston and Ouachita Mtns., Ozark Hills, Prairie Plains, Salem and Springfield Plateaus; on various types of substrates—bases of tree, sandy soil, soil pockets of sandstone, dolomite, granite, and rhyolite boulders. In urban areas very common on cedar shingle roofs.

This species is often anomalous particularly when sterile. Amateur and professional alike have been fooled by its many forms. However, the intersections of the collenchymatous median leaf-cells are characteristic when viewed under low magnification (*ca.* 100 ×) in that they usually appear as a row of small four-pointed stars due to refraction of light.

3. *Ditrichum* Hampe

Small caespitose mosses; leaves loosely spreading to erect, green to light green or yellowish; costa broad, percurrent to excurrent; upper leaf-cells subquadrate to long rectangular, smooth; seta slender, long; capsule oblong, cylindric to ovoid, erect to inclined.

a. Leaves long, linear-subulate, more or less erect to loosely spreading; awn slender, as long as to much longer than broad base; apex acute .... b
a. Leaves not long, linear-subulate, appressed; awn shorter than broad base; apex obtuse .... 2. *D. lineare*
  b. Seta red; upper leaves 2–3 mm long; costa in awn clearly distinct .... 1. *D. pusillum*
  b. Seta yellow; upper leaves often more or less secund, 3–5 mm long; costa in awn indistinct .... 3. *D. pallidum*

1. *Ditrichum pusillum* (Hedw.) Hampe

Uncommon, Ozark Hills, Prairie Plains, Salem Plateau; on soil, especially along creeks and gullies.

2. *Ditrichum lineare* (Sw.) Lindb.

Apparently rare, eastern Salem Plateau; in crevices of moist sandstone and rhyolite rocks.

3. *Ditrichum pallidum* (Hedw.) Hampe

Very common throughout Interior Highlands; on bare soil of woods and fields, occasionally in moist rock crevices.

Sterile plants may be confused with *Dicranella heteromalla*; however, in that species the leaves are more consistently secund and the plants are usually much taller (0.5–4 cm).

5. BRYOXIPHIACEAE

1. *Bryoxiphium* Mitt.

Slender plants similar to *Fissidens*; leaves conduplicate, not clasping the stem at base; stem with a bulb-like base.

Many authors place the genus *Bryoxiphium* in the Fissidentaceae. However, Löve and Löve (1953) have concluded from their rather exhaustive study of this genus that it should be placed in a separate family.

1. *Bryoxiphium norvegicum* (Brid.) Mitt. subsp. *norvegicum* var. *norvegicum*

Rare, Boston and Ouachita Mtns., Prairie Plains, eastern Salem Plateau, where plants may be abundant on moist, shaded vertical sandstone bluffs beneath overhanging ledges.

6. SELIGERIACEAE

Plants very small, less than 1 mm tall, gregarious, green to dark brownish-green; leaves subulate from a broader, sheathing, ovate-lanceolate base, costate; margins entire to serrulate; alar cells enlarged to undifferentiated; seta straight, longer than perichaetial leaves; capsule small, pyriform; peristome of 16 teeth or absent.

In the Interior Highlands this family is represented by a single genus, *Seligeria*, whose alar cells are undifferentiated. *Seligeria* is commonly found growing on calcareous rocks, especially on the overhanging ledges.

1. *Seligeria* B.S.G.

a. Peristome lacking .... 1. *S. donniana*
a. Peristome present .... b
  b. Awn short and thick, usually developing abruptly from the sheathing base .. 2. *S. calcarea*
  b. Awn not short and thick, usually slender, gradually tapering from a lanceolate base .... 3. *S. pusilla*

1. *Seligeria donniana* (Sm.) C. Müll.

Sterile forms of this taxon cannot be adequately distinguished from the next taxon. Although not yet reported from the Interior Highlands, there is no phytogeographic reason for its absence. Further field studies may yet reveal its presence in our area.

2. *Seligeria calcarea* (Hedw.) B.S.G.

Uncommon, Boston Mtns., Salem and Springfield Plateaus; in crevices and pockets of shaded calcareous rocks. Probably more common in the Interior

Highlands than distribution records indicate as it is seldom collected if not carefully searched for.

3. *Seligeria pusilla* (Hedw.) B.S.G.

Reported from eastern Salem Plateau in Franklin County, Missouri (Gier, 1955*a*: 38).

7. DICRANACEAE

Plants erect, variable in size, usually growing in mats or tufts, pale, to yellowish, to dark green; stems often branching, densely foliate and tomentose; leaves costate, variable in outline, straight, often curved, secund, sometimes crispate or subulate; leaf-cells smooth or papillose, variable in shape from rectangular near the base to shorter, often irregular or isodiametric near the apex; alar cells frequently clearly differentiated into distinct auricles; capsule short to long exserted, curved or erect, pyriform to cylindrical; peristome absent or of 16 teeth, each divided ½ or more into 2 slender divisions.

Cytological evidence presented by Bryan (1956) indicates that the genera *Bruchia* and *Trematodon* should be included in this family as it was originally conceived by Brotherus (1924:172–214) and not in the Ditrichaceae.

a. Plants small; leaves subulate to ovate-lanceolate, not secund; capsule obovoid to pyriform, inoperculate .... 1. *Bruchia*
a. Plants small to large; leaves narrowly to broadly lanceolate or subulate, often secund; capsule cylindrical, often curved, operculate .... b
b. Capsule with a long, slender neck .... 2. *Trematodon*
b. Capsule without a long, slender neck c
c. Alar cells conspicuously inflated or enlarged .... f
c. Alar cells not conspicuously inflated or enlarged .... d
d. Leaves crisped when dry .... 4. *Rhabdoweisia*
d. Leaves not crisped when dry .... e
e. Costa at least ¾ the width of the leaf base; plants pale green; numerous rudimentary branchlets often present in the axils of upper leaves .... 7. *Brothera*
e. Costa less than ⅓ the width of the leaf at base; plants darker green; rudimentary branchlets absent .... 3. *Dicranella*
f. Costa less than ½ the width of the leaf at base .... 5. *Dicranum*
f. Costa ½–¾ the width of the leaf at base .... 6. *Campylopus*

1. *Bruchia* Schwaegr.

Small gregarious plants of moist soil in open fields and pastures; leaves subulate to abruptly acuminate from an ovate to lanceolate base; seta shorter than to barely as long as perichaetial leaves; capsule pyriform, inoperculate.

A difficult genus for which mature fruiting material is generally required for identification of the species. Although *Bruchia donnellii* and *B. texana* have been reported from the Interior Highlands, they have been excluded for lack of reliable material to study.

a. Leaves short acuminate, imbricate-appressed .... 2. *B. hallii*
a. Leaves subulate-lanceolate, not imbricate-appressed .... 1. *B. flexuosa*

1. *Bruchia flexuosa* (Sw. *ex* Schwaegr.) C. Müll.

Bruchia sullivantii Aust.

Rare, Boston and Ouachita Mtns., Ozark Hills, and Salem Plateau; on damp soil of open fields and pastures. Sporophytes maturing in late spring or early summer.

2. *Bruchia hallii* Aust.

Rare, Springfield Plateau; on open sandy soil.

2. *Trematodon* Michx.

1. *Trematodon longicollis* Michx.

Plants gregarious to scattered, yellowish green in color; leaves more or less crisped when dry, gradually tapering from a broad, clasping base to a lanceolate or subulate apex; margins more or less revolute; costa percurrent; leaf-cells smooth, thin-walled, elongate hexagonal above, rectangular below; seta 2–3 cm long; capsule very distinctive, operculate, yellow to yellow-orange with a neck about twice as long as urn; operculum long rostrate.

Uncommon, Boston Mtns., Ozark Hills, Springfield Plateau; on open sandy soil along creek and river bottoms and in open woods.

3. *Dicranella* (C. Müll.) Schimp.

Plants small, gregarious or forming open to dense tufts or mats, bright green to yellowish green; leaves ovate-lanceolate to narrowly lanceolate from a sheathing base, often falcate secund; costa less than ⅓ the width of the leaf at base; alar cells not differentiated; seta red to yellow, 5–30 mm long; capsule erect to inclined and curved, smooth to furrowed when dry and empty; operculum rostrate; peristome of 16 single teeth divided to near the middle into 2–3 papillose divisions.

Key to Fruiting Plants

a. Mature capsules erect, symmetric or nearly so, seta red-brown .... 1. *D. rufescens*
a. Mature capsule inclined, unsymmetric; if erect then distinctly furrowed when dry .... b
  b. Capsule plicate or furrowed when dry and empty; seta yellow .... 3. *D. heteromalla*
  b. Capsule smooth or only slightly furrowed when dry and empty; seta reddish .... 2. *D. varia*

Key to Sterile Plants (Less Reliable)

a. Margins of leaves recurved, entire .... 2. *D. varia*
a. Margins of leaves plane, entire to serrulate .... b
  b. Margins of leaves entire except at apex; leaves erect-spreading to slightly secund; mostly of moist, open soil along streams and ditches .... 1. *D. rufescens*
  b. Margins of leaves serrulate nearly to base; leaves usually clearly falcate-secund; habitat various .... 3. *D. heteromalla*

1. *Dicranella rufescens* (With.) Schimp.

Rare, Salem Plateau; on moist soil, chiefly bare of other plants.

2. *Dicranella varia* (Hedw.) Schimp.

Uncommon, Ozark Hills, Springfield and Salem Plateaus; on moist soil and rocks, chiefly along streams and ditches.

3. *Dicranella heteromalla* (Hedw.) Schimp.

a. Capsule erect and symmetric, urn coarsely furrowed when dry and empty .... 3b. *D. heteromalla* var. *orthocarpa*
a. Capsule inclined and asymmetric, capsule plicate when dry and empty .... 3a. *D. heteromalla* var. *heteromalla*

3a. *Dicranella heteromalla* var. *heteromalla*

Very common throughout the Interior Highlands; on apparently all types of soil or rock substrates.

3b. *Dicranella heteromalla* var. *orthocarpa* (Hedw.) Jaegr. & Sauerb.

Rare, Ozark Hills; on sandstone.

4. *Rhabdoweisia* B.S.G.

1. *Rhabdoweisia denticulata* (Brid.) B.S.G.

Plants small, tufted, yellowish to dark green; leaves oblong to linear-lanceolate, crisped when dry, finely serrulate above, teeth often few and distant, apex acute; costa stout, ending just below apex; upper leaf-cells mostly round-quadrate, obscurely papillose; seta erect, 2–5 mm long, yellow; capsule ovoid, 8-plicate; peristome teeth 16, undivided.

Rare, Boston and Ouachita Mtns., eastern Salem Plateau; on vertical sandstone.

5. *Dicranum* Hedw.

Plants small to large, in loose to dense tufts, yellowish to dark green, usually radiculose below; leaves lanceolate to ovate-lanceolate, erect-spreading, crisped, or falcate-secund, narrowly costate with distinctly enlarged alar cells; basal leaf-cells rectangular to elongate, walls often pitted; upper leaf-cells rectangular, oblong-rhomboidal, or irregularly shaped, walls plain to pitted, often papillose on the lower surface; seta erect; capsule cylindrical and symmetrical to inclined, curved and asymmetrical; operculum long rostrate; peristome teeth red, single, 16, divided to near the middle into 2–3 divisions.

a. Walls of lower leaf cells not pitted .... b
a. Walls of lower leaf cells pitted .... d
  b. Costa broad, ⅓ or more the width of the leaf base .... 3. *D. fulvum*
  b. Costa narrower, ⅐–⅕ the width of the leaf base c
c. Leaves strongly crisped when dry, margins irregularly serrate to serrulate; flagelliform branches absent .... 1. *D. montanum*
c. Leaves crisped, erect-spreading to secund when dry, margins essentially entire; flagelliform branches usually present .... 2. *D. flagellare*
  d. Upper leaf-cells elongate, more or less pitted .... f
  d. Upper leaf-cells 1–2 : 1 .... e
e. Leaves widest some distance above base; upper leaf-cells irregular in shape, highly mammillose lower surface .... 5. *D. spurium*

e. Leaves widest near the base; upper leaf cells more or less uniform in shape, smooth or slightly papillose on lower surface .... 4. *D. sabuletorum*
  f. Leaves distinctly transversely undulate .... 6. *D. polysetum*
  f. Leaves not transversely undulate .... 7. *D. scoparium*

1. *Dicranum montanum* Hedw.

Uncommon, Boston and Ouachita Mtns., Ozark Hills, Prairie Plains, Salem Plateau; on shaded dolomite, rhyolite, sandstone, and bases of trees.

2. *Dicranum flagellare* Hedw.

Common, Boston and Ouachita Mtns., Ozark Hills, Salem Plateau, St. Francois Mtns.; mostly on decaying wood, occasionally on shaded sandstone.

3. *Dicranum fulvum* Hook.

Common throughout the Interior Highlands; on vertical, shaded, non-calcareous rocks.

4. *Dicranum sabuletorum* Ren. & Card.

Common throughout the Interior Highlands; on rocky soil, decaying wood, crevices and ledges of rocks. Often mixed with *Dicranum scoparium.*

5. *Dicranum spurium* Hedw.

Uncommon, Boston and Ouachita Mtns., Ozark Hills, Salem Plateau, St. Francois Mtns.; on rock ledges, especially granite, sandstone and dolomite, occasionally on rocky, acid soil of ridges.

6. *Dicranum polysetum* Sw.

Dicranum rugosum (Funck) Hoffm. *ex* Brid.
Dicranum undulatum Ehrh. *ex* Web & Mohr

Rare, known only from the Springfield Plateau in Barry Co., Missouri, where it occurred on soil in a mixed oak-cedar forest along a ridge *ca.* ½ mile east of Roaring River State Park.

7. *Dicranum scoparium* Hedw.

Very common throughout the Interior Highlands; on soil of ridges, wooded slopes, and rock ledges. Occasionally on decaying wood and bases of trees.

6. *Campylopus* Brid.

Plants dark to yellowish green, in loose to compact tufts; leaves erect spreading to secund, narrowly lanceolate-subulate; costa often to ¾ width of the leaf base, in cross section showing stereid cells above and below guide cells, upper surface cells larger than guide cells; seta 5–10 mm long; capsule ovoid, cylindric to pyriform elliptic; peristome of 16 teeth divided to near the middle into papillose divisions; apparently fruiting infrequently.

a. Leaves, particularly older ones, ending in a hyaline hair point; narrow rectangular hyaline cells extending up the margin from base as in *Tortella* .... 2. *C. introflexus*
a. Leaves without hyaline hair points; no hyaline cells extending up margin .. 1. *C. flexuosus*

1. *Campylopus flexuosus* (Hedw.) Brid.

Campylopus tallulensis Sull. & Lesq.

Uncommon, Boston and Ouachita Mtns., eastern Salem Plateau; on shaded sandstone.

2. *Campylopus introflexus* (Hedw.) Brid.

Uncommon, Boston and Ouachita Mtns.; on open flat (occasionally vertical) exposures of sandstone and novaculite. Often forming extensive cushions.

Excluded species:

Campylopus fragilis (Brid.) B. S. G.—The collection cited by Lowe (1919) is *C. flexuosus.*

7. *Brothera* C. Müll.

1. *Brothera leana* (Sull.) C. Müll.

Common, Boston Mtns., Ozark Hills, Salem and Springfield Plateaus; usually in crevices of dolomite or sandstone of bluffs, particularly along the upper reaches of bluffs and cliffs.

Excluded taxa:

Dicranoweisia cirrata (Hedw.) Lindb. *ex* Milde and *D. crispula* (Hedw.) Lindb. *ex* Milde—Collections from Arkansas determined as these species are *Weissia controversa.*

8. LEUCOBRYACEAE

1. *Leucobryum* Hampe

Plants in whitish to glaucous, dense, spongy, cushion-like tufts, often to one foot in diameter; stems erect, to 15 cm or more high; leaves thick, lanceolate, the base composed almost entirely of a broad costa composed of 2 or more layers of large, empty, hyaline cells surrounding a layer of small chlorophyllose-cells; seta erect; capsule erect and symmetric to inclined and asymmetric; peristome single, composed of 8 or 16 teeth, entire or split to the middle into two sections.

a. Leaves in cross section near the base at the middle of the costa 4–5 layers of cells thick (2 layers of hyaline cells above and 1–2 layers below a single layer of chlorophyllose cells); leaves 5–8 mm long .... 1. *L. glaucum*

a. Leaves in cross section near the base at the middle of the costa 3 layers of cells thick (1 layer of hyaline cells above and below a single layer of chlorophyllose cells); leaves 2–4.5 mm long .... 2. *L. albidum*

1. *Leucobryum glaucum* (Hedw.) Ångstr. *in* Fr.

Very common throughout the Interior Highlands; on acid soil of ridges, on rock ledges, particularly granite, rhyolite, felsite, sandstone, and dolomite. Often mixed with *Polytrichum* and *Dicranum.*

Plants growing under dry conditions, particularly along oak-hickory ridges, are difficult to separate from the next species. However, structural differences of the lower costa as well as examination of older stem leaves will usually prove the key characters to be reliable.

2. *Leucobryum albidum* (Brid. *ex* P. Beauv.) Lindb.

Common throughout the Interior Highlands; on soil, bases of trees, and rock ledges.

9. CALYMPERACEAE

1. *Syrrhopodon texanus* Sull.

Plants tufted, often forming extensive dark green or brown cushions, 1–4 cm high; leaves crisped when dry, linear to lingulate, often appearing whitish near tips; marginal cells elongated, hyaline, and coarsely toothed; costa rough on both surfaces; upper leaf-cells papillose; basal cells hyaline, forming acute angles above; sporophytes unknown in material from the Interior Highlands.

Rare, Boston Mtns., Ozark Hills, and eastern Salem Plateau; on vertical shaded sandstone and shaded soil.

10. ENCALYPTACEAE

1. *Encalypta procera* Bruch

Encalypta streptocarpa Hedw. (*sensu* Flowers).

Plants in loose, brownish green tufts; leaves crisped when dry, broad, lingulate; costa single; upper leaf-cells short, densely papillose; basal leaf-cells hyaline, oblong, smooth; filamentous brood bodies arising from leaf axils.

Rare, Salem Plateau; on exposed soil of ridge. Known only from Ozark County, Missouri, from a NW facing cherty slope *ca.* 3 miles SE of Dora, SW ¼ Sect. 14, T. 24 N., R. 11 W. When dry, colonies may be mistaken for *Atrichum angustatum.*

11. POTTIACEAE

Plants variable in size, erect to decumbent, in loose to dense tufts, yellowish to dark green to blackish in color; leaves variable in shape, frequently contorted when dry; costa strong, often long excurrent; basal leaf-cells usually thin walled and hyaline; upper leaf-cells small, isodiametric, thick-walled and more or less papillose; alar cells not differentiated; capsule usually erect, sessile to long exserted on a straight seta; peristome when present composed of 16 teeth, often divided and spirally twisted.

a. Plants small, bulbiform; upper leaves broadly ovate; cells smooth; capsule immersed .... 13. *Acaulon*
a. Plants not as above .... b
  b. hyaline cells of leaf-base extending up the margin further than along the costa, forming a V; leaves oblong-lanceolate to broadly lanceolate-acuminate c
  b. Hyaline cells of leaf base not as above; if faintly showing V-shaped arrangement of hyaline basal cells, then leaves narrowly lanceolate to linear-lanceolate .... d

c. Hyaline cells of leaf base not reaching the costa .... 8. *Pleurochaete*
c. Hyaline cells of leaf base reaching the costa .... 7. *Tortella*
  d. Margins of the upper half of leaf involute .... e
  d. Margins of the upper half of leaf plane or reflexed .... f
e. Peristome present, inserted at the mouth of the capsule; costa 60 μ or more wide at base; leaves linear-lanceolate from a broadly oblong to oblong-lanceolate base .... 6. *Trichostomum*
e. Peristome absent; if present, inserted below the mouth of the capsule; costa 50 μ or less wide at base, if wider, then leaves narrowly oblong-lanceolate .... 2. *Weissia*
  f. Leaves erect-spreading, tips usually curled, very narrowly linear .... 6. *Trichostomum*
  f. Leaves not possessing this combination of characters .... g
g. Leaves bordered by a band of 2–3 rows of slightly elongated, lighter colored cells .... 15. *Desmatodon*
g. Leaves not bordered as above .... h
  h. Leaves strongly papillose with many of the papillae c-shaped i
  h. Leaves smooth; if papillose, papillae not c-shaped .... j
i. Leaves without excurrent costa; if costa excurrent, upper hyaline basal cells with distinct trigones; plant small, usually less than 5 mm tall .... 15. *Desmatodon*
i. Leaves with excurrent costa (may be short); upper hyaline basal cells without distinct trigones; plant taller, 0.5 cm or more tall; if shorter, plants bearing propagula .... 16. *Tortula*
  j. Leaf margins in upper half reflexed; if plane, then leaves either torn and broken, or plants growing on trees .... k
  j. Leaf margins plane; leaves not torn or broken; plants not growing on trees .... s
k. Costa with a single dorsal stereid band l
k. Costa with two stereid bands .... n
  l. Costa ending below the apex, spurred above .... 4. *Husnotiella*
  l. Costa excurrent, not spurred above .... m
m. Leaves ovate to oblong-lanceolate; apex acuminate; growing on soil .... 14. *Phascum*
m. Leaves obovate, lingulate or spatulate, ovate-lanceolate to oblong; apices acute, obtuse, emarginate, truncate or blunt; plants on rocks and trees .... 16. *Tortula*
  n. Leaf margins 2–3-stratose .... 10. *Didymodon*
  n. Leaf margins not bistratose .... o
o. Upper leaf cells not to only weakly papillose .... p
o. Upper leaf cells distinctly papillose .... q
  p. Basal leaf-cells hardly different from upper leaf-cells .... 10. *Didymodon*
  p. Basal leaf-cells thin-walled, clearly different from upper-leaf cells .... 12. *Barbula*
q. Peristome teeth twisted .... 12. *Barbula*
q. Peristome teeth erect, not twisted .... r
  r. Leaves entire throughout .... 10. *Didymodon*
  r. Leaves denticulate to strongly dentate at apex .... 11. *Bryoerythrophyllum*
s. At least some of the leaves broadly lingulate .... y
s. Leaves not broadly ligulate .... t
  t. Leaves toothed just above the base at the upper margin of the hyaline cells .... 5. *Eucladium*
  t. Leaves not as above .... u
u. Costa ending somewhat below apex; plants growing on vertical calcareous rocks .... z
u. Costa percurrent to excurrent; if ending below apex, plants growing on soil v
  v. Leaf apex obtuse .... 12. *Barbula*
  v. Leaf apex acute .... w
w. Leaves closely imbricate when dry .... 12. *Barbula*
w. Leaves crisped or curled when dry x
  x. Leaf cells pluripapillose; the cells of basal ¼ of leaves rectangular, elongated, hyaline; plants yellowish green .... 6. *Trichostomum*
  x. Leaf cells bipapillose; the basal ¼ of leaves with few and inconspicuously elongate cells; plants bluish green .... 1. *Anoectangium*
y. Plants with numerous polymorphous gemmae in axils of upper leaves .... 9. *Hyophila*
y. Plants without gemmae .... 17. *Scopelophila*
  z. Leaves bistratose in patches; archegonial inflorescences laterial .... 1. *Anoectangium*
  z. Leaves not bistratose; archegonial inflorescences terminal .... 3. *Gymnostomum*

1. *Anoectangium* Schwaegr.

Plants tufted, whitish to bluish green; leaves contorted when dry, linear-ligulate to linear-lanceolate, apex obtuse to acute; margins plain, entire; costa ending below apex; upper leaf-cells papillose; basal leaf-cells hyaline and rectangular; archegonial and antheridial inflorescences lateral.

a. Leaves acute, bluish green .... 1. *A. sendtnerianum*
a. Leaves obtuse, whitish .... 1. *A. obtusifolium*

1. *Anoectangium sendtnerianum* B.S.G.

Molendoa sendtneriana (B.S.G.) Limpr.

Rare, Boston Mtns.; on moist calcareous rocks.

This species may be confused with *Trichostomum cylindricum.* Iwatsuki and Sharp (1958) have observed that the latter taxon differs from *A. sendtnerianum* by having 3 or more papillae per cell and large, rectangular, elongated, and hyaline cells in the basal quarter of the leaf.

2. *Anoectangium obtusifolium* (Broth. & Par. *ex* Card.) Grout

Rare, Boston Mtns.; on sandstone. May grow mixed with *Eucladium verticillatum.*

2. *Weissia* Hedw.

Small, densely tufted, yellowish to bluish green plants; leaves narrowly lanceolate, costate; margins strongly involute to plane above, erect-spreading when moist, crispate when dry; upper leaf-cells strongly papillose; capsule immersed or exserted; operculum functional to non-functional; peristome absent or of 16 teeth inserted below the mouth of the capsule.

a. Capsules immersed in perichaetial leaves .... b
a. Capsules exserted beyond perichaetial leaves c
  b. Setae often clustered; leaf margins both plane and involute above .... 2. *W. ludoviciana*
  b. Setae solitary; leaf margins strongly involute above .... 1. *W. muehlenbergiana*
c. Costa 70 μ or more in width at base of leaf .... 4. *W. tortilis*
c. Costa less than 60 μ in width at base of leaf .... 3. *W. controversa*

1. *Weissia muehlenbergiana* (Sw.) Reese & Lemmon (1965).

Astomum muehlenbergianum (Sw.) Grout

Common throughout the Interior Highlands; on open soil of fields, road banks, paths, and lawns. Sporangia produced in late winter and early spring.

2. *Weissia ludoviciana* (Sull.) Reese & Lemmon (1965).

Astomum ludovicianum (Sull.) Sull.

Very rare, Arkansas River Valley; on open soil.

3. *Weissia controversa* Hedw.

Weissia viridula Hedw.

Plants gregarious, small; leaves lanceolate; costate; cells very papillose above; leaf margins entire, strongly involute above; capsule cylindrical, smooth or plicate when dry, exserted on a yellow seta; operculum functional; peristome of 16 teeth.

Two varieties are represented in the Interior Highlands and may be separated as follows:

a. Seta 3–8 mm long .... 3a. *W. controversa* var. *controversa*
a. Seta 10–15 mm long .... 3b. *W. controversa* var. *longiseta*

3a. *Weissia controversa* var. *controversa*

Very common throughout the Interior Highlands; on soil and rocks of open areas such as lawns, pastures, roadways.

3b. *Weissia controversa* var. *longiseta* (Lesq. & James) Crum, Steere & Anderson (1964).

Weissia viridula Hedw. var. *australis* Aust.

Reported from eastern Salem Plateau in Franklin, St. Louis, and Ste. Genevieve Counties, Missouri, by Gier (1955*a*:38).

4. *Weissia tortilis* (Schwaegr.) C. Müll.

Rare, known only from a collection by Moore (1965) from Conway Co., Arkansas, in the eastern Boston Mtns.

When sterile this species may be confused with *Trichostomum jamaicensis*. However, the linear-lanceolate leaves with oblong-ovate base easily separate this species from *Weissia tortilis*. May be a tetraploid of *W. controversa* (L. E. Anderson, personal communication).

3. *Gymnostomum* Nees, Hornsch. & Sturm

Densely tufted mosses, usually growing on moist, vertical limestone, often forming dense cushions several centimeters deep, dull to bright green in color; leaves erect-spreading when moist, little contorted to suppressed, incurved, and contorted when dry, oblong- to linear-lanceolate, keeled, apex acutely obtuse to acute; costa strong, vanishing below apex; upper leaf-cells papillose; seta long exserted, erect; capsule erect, symmetric, oval to oblong, glossy at maturity; operculum long rostrate; peristome absent.

a. One or both margins recurved below; leaves little contorted when dry; upper leaf-cells clear, 12–15 μ wide; operculum usually remaining attached to exserted columella .... 2. *G. recurvirostrum*
a. Leaf margins not recurved; leaves usually crispate when dry; upper leaf-cells obscure, 7–12 μ wide, densely papillose; operculum not persistent .... 1. *G. aeruginosum*

1. *Gymnostomum aeruginosum* Sm.

Common, Boston Mtns., Ozark Hills, Prairie Plains, Salem and Springfield Plateaus; on vertical, moist limestone and sandstone especially at bases of bluffs.

Confusion between this species and *Gymnostomum calcareum* Nees & Hornsch. is, as noted by Crum and Anderson (1956), quite common in this country. These authors have come to the conclusion that nearly all specimens called *G. calcareum* in the United States are forms of *G. aeruginosum*. Only from California have they seen specimens which they felt could essentially be assigned to *G. calcareum.* There is apparently a taxonomic problem involved here which can only be resolved by a careful world-wide monographic study. Until this is done a conservative position is followed, and all the material from the Interior Highlands is assigned to *G. aeruginosum.*

2. *Gymnostomum recurvirostrum* Hedw.

a. Papillae of leaf-cells comparatively few; stems not papillose .... 2a. *G. recurvirostrum* var. *recurvirostrum*
a. Leaf-cells densely papillose; stems papillose .... 2b. *G. recurvirostrum* var. *latifolium*

2a. *Gymnostomum recurvirostrum* var. *recurvirostrum*

Common, Boston Mtns., Salem and Springfield Plateaus; on moist, vertical limestone and dolomite. Occasionally on sandstone.

2b. *Gymnostomum recurvirostrum* var. *latifolium* (Zett.) Flow. *ex* Crum

Gymnostomum recurvirostrum Hedw. var. *scabrum* (Lindb.) Grout

Uncommon, Boston Mtns., Salem Plateau; on limestone and occasionally on sandstone.

4. *Husnotiella* Card.

1. *Husnotiella revoluta* Card. var. *palmeri* (Card.) Bartr.

Plants small, 4–6 mm tall, in dense, light green tufts; leaves erect spreading when moist, contorted when dry, linear-lingulate, acute to apiculate; margins entire, revolute above; costa strong, ending abruptly below the apex, wider and spurred on dorsal surface; leaf-cells small, 7–10 μ in diameter, obscure, rounded and more or less papillose.

Rare, known only from a collection made by W. B. Drew (67) from the Salem Plateau at Alley Spring State Park, Shannon Co., Missouri, on soil of limestone ledge.

May be confused with *Didymodon tophaceus* from which it may be distinguished by the possession of a spurred costa and absence of strongly decurrent leaves.

5. *Eucladium* B.S.G.

1. *Eucladium verticillatum* (Brid.) B.S.G.

Plants in dense, light to dark green tufts, 1–3 cm tall, frequently white below due to encrustations of lime; leaves appressed to spreading when dry, erect to widely spreading when moist, linear-lanceolate to linear-subulate, acute; costa strong, usually excurrent; margins plane, toothed at base just above hyaline basal cells; upper leaf-cells clear, papillose, rectangular to quadrate, thick-walled; lower leaf-cells hyaline and larger than upper cells.

Common, Boston Mtns., Ozark Hills, Salem and Springfield Plateaus; on vertical to underside of overhanging limestone (rarely sandstone) subject to seepage.

6. *Trichostomum* Bruch

Plants small to moderate in size, 5–30 mm tall, yellowish green to dark green, in loose to dense tufts; leaves linear-lanceolate, to 8 mm long, strongly contorted when dry, involute to nearly plane above; costa strong, usually excurrent; leaf-cells small and densely papillose; capsule cylindrical, exserted upon an erect seta 8–15 mm long; peristome teeth 16, inserted at the mouth of the capsule.

a. Margin of upper leaf plane or involute only near apex .... b
a. Margin of upper leaf strongly involute .... 1. *T. jamaicense*
  b. Leaves distinctly curled from tip when dry, very narrowly linear, plane to apex .... 3. *T. mollissimum*
  b. Leaves twisted but not curled from tip when dry, linear-lanceolate to ligulate, often involute near apex .... 2. *T. tenuirostre*

1. *Trichostomum jamaicense* (Mitt.) Jaeg. & Sauerb.

Weissia jamaicense (Mitt.) Grout

Uncommon, Boston Mtns., Salem and Springfield Plateaus; on limestone, dolomite, felsite and sandstone.

When sterile this species may be confused with *Weissia controversa* and *W. tortilis*. Generally plants of *W. controversa* are shorter, their leaves are tightly crispate, and the costa is less than 50 μ wide near the base. In contrast, plants of *W. jamaicensis* are taller, and their leaves are more loosely crispate with the leaves curled mainly at the tips. The costa usually exceeds 65 μ in width near the base.

2. *Trichostomum tenuirostre* (Hook. & Tayl.) Lindb.

Trichostomum cylindricum (Bruch) C. Müll.

Rare, Boston Mtns., Salem Plateau; on rocks. Reported from Taney County, Missouri, by Gier (1955*a*: 38) and Missouri (no County given) by Crum and Anderson (1958). This latter paper should be consulted for an excellent discussion of the variability of this taxon.

3. *Trichostomum mollissimum* (Broth. *ex* Bartr.) Crum

Tortella mollissima Broth. *ex* Bartr.

Rare, SW-Salem Plateau in Douglas County, Missouri; on sandy, vertical shaded dolomite, growing with *Myurella sibirica*.

The status of this taxon leaves much to be desired. L. E. Anderson (personal communication) believes that the plants from Douglas County are *T. tenuirostre*.

7. *Tortella* (C. Müll.) Limpr.

1. *Tortella humilis* (Hedw.) Jenn.

Plants in erect, loose to dense yellowish green to green tufts; leaves crisped when dry, oblong-lanceolate, apex acute to obtuse; margins plane, entire, sometimes undulate; costa shortly excurrent in a mucro-point; upper leaf-cells small, densely papillose; lower leaf-cells hyaline, rectangular, extending obliquely higher up the margin than the costa, abruptly becoming small and chlorophyllose; capsule oblong, exserted on a seta about 1.5 cm long; peristome teeth 32, twisted 2–3 times.

Very common throughout the Interior Highlands; on decaying wood, bases of trees, and soil; occasionally on rocks.

Excluded species:

Tortella tortuosa (Hedw.) Limpr.—Reports from Taney County, Missouri, by Gier (1955*a*: 38) are based upon collection by H. S. Conard (Nov. 30, 1940) and Paul Rissens (Aug. 29, 1931) deposited in the Herbarium of the State University of Iowa. Both of these collections have been examined and are *Tortella humilis.*

8. *Pleurochaete* Lindb.

1. *Pleurochaete squarrosa* (Brid.) Lindb.

Plants in loose tufts, 1–10 cm tall, often decumbent, yellow-green in color; leaves flexuose when dry, squarrose when moist, lanceolate-acuminate from a wide, sheathing base; margins finely serrate, undulate; costa strong, excurrent to percurrent; upper leaf-cells quadrate, papillose; marginal basal cells rectangular, hyaline for 5–7 cells in towards the costa below, decreasing to 1–2 cells above; median basal cells rectangular, colored; plants usually not fruiting.

Common, Boston Mtns., Salem and Springfield Plateaus; on soil in glades when limestone or sandstone rocks are close to the surface. Usually forms very loose mat-like growths, especially beneath cedar trees.

9. *Hyophila* Brid.

1. *Hyophila involuta* (Hook.) Jaeg. & Sauerb.

Hyophila tortula (Schwaegr.) Hampe

Plants in dark green tufts; leaves inrolled and curled when dry, lingulate, obtuse, nearly entire to coarsely serrate above; margins plane above, recurved below; costa strong, ending below apex to slightly excurrent; upper leaf-cells quadrate, slightly papillose to smooth; basal leaf-cells rectangular; polymorphic gemmae in axils of upper leaves; sporophytes absent.

Common throughout the Interior Highlands; on shaded rocks in and along edges of creeks and streams.

10. *Didymodon* Hedw.

Plants in short to tall, light to dark green tufts; leaves ovate-lanceolate to lingulate from a broader base, twisted to only incurved when dry, erect-spreading when moist, apices acute to obtuse; margins entire, revolute to plane above, recurved below, one to 2–3 stratose; costa strong, percurrent to sub-percurrent, both dorsal and ventral rows of stereids present in cross section; upper leaf-cells small, round, smooth or papillose, slightly elongated at base; capsule erect, cylindric, exserted upon a short, 1–1.5 cm long, red seta; peristome teeth 16, variously divided, straight to slightly twisted.

a. Margin of leaves 2–3 stratose in upper part .... 1. *D. rigidulus*
a. Margin of leaves unistratose, recurved in upper part .... b
    b. Leaves strongly decurrent; leaf-cells papillose .... 2. *D. tophaceus*
    b. Leaves not strongly decurrent; leaf-cells smooth to only weakly papillose .... 3. *D. trifarius*

1. *Didymodon rigidulus* Hedw.

Rare, known only from the southern Springfield Plateau from a collection by R. R. Ireland, Jr. (*3520*, US) from Roaring River State Park, Barry Co., Missouri; on limestone rock outcrop.

2. *Didymodon tophaceus* (Brid.) Lisa

Uncommon, Salem and Springfield Plateaus; on moist, shaded calcareous rocks, especially where seepage occurs, rarely on soil.

3. *Didymodon trifarius* (Hedw.) Röhl.

Reported from the Salem Plateau in Camden and Dallus Counties, Missouri, by Gier (1955*a*: 34).

11. *Bryoerythrophyllum* Chen

1. *Bryoerythrophyllum recurvirostrum* (Hedw.) Chen

Didymodon recurvirostris (Hedw.) Jenn.

Plants in loose green tufts, tending to be reddish brown below; leaves erect-spreading when moist, crisped, flexuous, and curled when dry, lanceolate from a broad base; margins revolute, dentate (often obscurely so) at apex; costa strong, excurrent in a pellucid apiculus; upper cells quadrate, densely papillose; lower cells rectangular, hyaline to reddish brown; capsule oblong-cylindric upon an erect, reddish seta; peristome teeth 16.

Uncommon, Boston Mtns., Salem and Springfield Plateaus; usually on calcareous rocks, occasionally on soil.

12. *Barbula* Hedw.

Plants small to moderate in size, 1–20 mm tall, in dense to loose tufts, dark green to yellowish green; leaves linear-lanceolate to ovate-lingulate, contorted or crisped when dry; margins entire, plane or revolute; costa strong, ending just below the apex to excurrent; upper leaf-cells small, thick-walled, papillose; basal cells larger, thin-walled and smooth; propagula often present; capsule exserted, cylindric; peristome teeth divided into 32 thread-like segments, usually strongly twisted.

a. Leaves oblong, lingulate or ligulate .... b
a. Leaves lanceolate or subulate, tapering gradually from an ovate base .... e
    b. Seta yellow; perichaetial leaves convolute .... 1. *B. convoluta*
    b. Seta red; perichaetial leaves not convolute c

c. Upper leaf-cells smooth to slightly papillose .... 4. *B. ehrenbergii*
c. Upper leaf-cells densely papillose .... d
  d. Propagula present .... 3. *B. cruegeri*
  d. Propagula absent .... 2. *B. unguiculata*
e. Cells of upper surface of costa linear .... 5. *B. fallax*
e. Cells of upper surface of costa quadrate .... 6. *B. acuta*

1. *Barbula convoluta* Hedw.

Uncommon, Boston Mtns., Salem Plateau; on shaded to open soil.

2. *Barbula unguiculata* Hedw.

Common, throughout the Interior Highlands; on calcareous soil and rock ledges, old fields, waste places, edges of creek and streams.

3. *Barbula cruegeri* Sond. *ex* C. Müll.

Common, Ouachita Mtns., Ozark Hills, Prairie Plains, Salem and Springfield Plateaus; on moist, calcareous rocks and rock crevices.

The status of this taxon in relation to *Barbula unguiculata* is confused especially in the Interior Highlands where both taxa occur. Gier (1955*a*: 32) calls attention to this problem and suggests controlled experiments might help resolve this problem.

4. *Barbula ehrenbergii* (Lor.) Fleisch.

Uncommon, Salem Plateau; on moist, shaded calcareous rocks. Plants are often encrusted with lime.

5. *Barbula fallax* Hedw.

Uncommon, Salem and Springfield Plateaus; on soil of crevices and ledges of limestone.

6. *Barbula acuta* (Brid.) Brid.

Two varieties are encountered in the Interior Highlands and may be separated as follows:

a. Plants in short dense tufts .... 6a. *B. acuta* var. *acuta*
a. Plants in loose, elongate tufts .... 6b. *B. acuta* var. *bescherellei*

6a. *Barbula acuta* var. *acuta*

Reported from the eastern Salem Plateau in St. Louis County, Missouri, by Gier (1955*a*: 32).

6b. *Barbula acuta* var. *bescherellei* (Sauerb. *ex* Jaeg. & Sauerb.) Crum (1969).

Rare, Springfield Plateau; on flat exposed limestone along dry creek bed in small ravine *ca.* 4 miles south of Springfield, on Mo. Hwy. 160.

13. *Acaulon* C. Müll.

1. *Acaulon muticum* (Hedw.) C. Müll. var. *rufescens* (Jaeg. & Sauerb.) Crum (1969).

Acaulon rufescens Jaeg. & Sauerb.

Plants sub-globose, bulbiform, small, less than 2 mm tall, yellowish green; leaves broadly ovate, concave; margins plane below, sharply serrate and reflexed above; costa strong, percurrent to excurrent; lower cells smooth, hyaline, rectangular, to 100 μ long; upper cells smooth, smaller, rhomboid-hexagonal; capsule erect, immersed, globose; spores smooth, 40–50 μ in diameter.

Rare, Boston Mtns., Ozark Hills, eastern Salem Plateau, Prairie Plains; on sandy soil.

14. *Phascum* Hedw.

1. *Phascum cuspidatum* Hedw.

Plants in dense light to yellow-green tufts; upper leaves largest, ovate to oblong-lanceolate, acuminate; margins entire and revolute in the middle; costa short to long excurrent; lower cells rectangular and hyaline below; upper cells quadrate to hexagonal, papillose; capsule ovoid-globose, immersed to slightly emergent, cleistocarpous.

Two varieties are present in the Interior Highlands and may be separated as follows:

a. Costa excurrent .... 1a. *P. cuspidatum* var. *cuspidatum*
a. Costa long excurrent .... 1b. *P. cuspidatum* var. *americanum*

1a. *Phascum cuspidatum* var. *cuspidatum*

Uncommon Prairie Plains, Springfield Plateau; on soil, often sandy, of old fields, pastures, and waste places.

1b. *Phascum cuspidatum* var. *americanum* Ren. & Card. *ex* Ren. & Thér.

Uncommon, Salem and Springfield Plateaus; habitats similar to var. *cuspidatum.*

15. *Desmatodon* Brid.

Plants small, usually less than 6 mm tall, in compact to loose, yellowish to dark green tufts; leaves closely appressed, often contorted when dry, obovate, oblong-lanceolate to oblong-lingulate, apex obtuse to acute; margins entire, plane to revolute nearly to apex; costa strong, sub-percurrent to excurrent in a smooth hair-point; upper cells irregularly quadrate, densely papillose with many c-shaped papillae; lower cells rectangular to elongate-hexagonal, smooth, pale; capsule oblong to cylindric, exserted upon an erect seta; peristome teeth 16, cleft to base, at times poorly developed.

a. Leaves bordered by a band of lighter-colored cells .... 1. *D. porteri*
a. Leaves not bordered .... b
  b. Upper leaves awned or hair-pointed .... 2. *D. plinthobius*
  b. Upper leaves not awned or hair-pointed .... 3. *D. obtusifolius*

1. *Desmatodon porteri* James *ex* Aust.

Uncommon, Boston Mtns., Ozark Hills, Salem and Springfield Plateaus; on dolomite and limestone.

2. *Desmatodon plinthobius* Sull. & Lesq. *ex* Sull.

Common, Boston and Ouachita Mtns., Prairie Plains, Salem and Springfield Plateaus; on limestone, dolomite, and sandstone.

3. *Desmatodon obtusifolius* (Schwaegr.) Schimp.

Common throughout the Interior Highlands; on sandy soil and sandstone, rarely dolomite and limestone.

16. *Tortula* Hedw.

Plants small to large, in dense to loose mats or rocks, soil or trees; leaves oblanceolate, obovate, spatulate, elongate-ligulate to elongate-spatulate, often forming a crowded rosette near the stem apex, twisted and appressed when dry, widely spreading when moist, apex obtuse, rounded, truncate or emarginate; margins plane to revolute; costa strong, excurrent as an awn; upper cells small, strongly papillose, basal cells much larger, smooth, hyaline, often appearing suddenly differentiated on each side of costa; brood-leaves (propagula) often present on surface of leaf or in the upper leaf axils.

a. Costate brood-leaves found in axils of upper stem leaves; upper leaves often torn and broken in various ways; costa shortly excurrent .... 2. *T. fragilis*
a. Plants not possessing the above combination of characteristics .... b
  b. Ecostate brood-leaves present in axils of upper leaves or on upper side of leaf costa c
  b. Brood-leaves absent .... d
c. Brood-leaves borne in axils of leaves at apex of stem .... 4. *T. pagorum*
c. Brood-leaves borne on upper surface of leaves .... 3. *T. papillosa*
  d. Awn smooth .... 1. *T. muralis*
  d. Awn sharply serrate .... 5. *T. ruralis*

1. *Tortula muralis* Hedw.

Reported from the Ouachita Mtns., McCurtain Co., Oklahoma, by Sharp (1930: 49).

2. *Tortula fragilis* Tayl.

Rare, Southwestern Springfield Plateau; on dry, vertical south-facing sandstone. Known only from Cherokee Co., Oklahoma.

3. *Tortula papillosa* Wils. *ex* Spruce

Rare, southern Springfield Plateau; on oak and cedar; probably also occurs on other trees.

4. *Tortula pagorum* (Milde.) De Not.

Common throughout the Interior Highlands; mainly on trees, but occasionally vertical calcareous and sandstone rocks.

5. *Tortula ruralis* (Hedw.) Gaertn., Meyer & Schreb.

Uncommon, Springfield Plateau; on open calcareous soil and rocks, especially along bluffs.

17. *Scopelophila* (Mitt.) Lindb.

1. *Scopelophila ligulata* (Spruce) Spruce

Merceya ligulata (Spruce) Schimp.

Plants in loose to compact tufts; leaves light to bright green in color above, often reddish to brown below; stems radiculose; leaves broadly spatulate to ligulate, broadest near apex, bluntly pointed on obtuse; margins entire and plane (may be slightly recurved below); costa ending in the apex; upper leaf-cells quadrate, oblong, to irregular; basal cells larger, thin-walled and often inflated, marginal basal cells narrower.

Rare, Ouachita Mtns., Ozark Hills; on sandy soil.

Considerable variation in morphology related to moisture has been reported by Noguchi (1956) and confirmed by Zander (1967). Both the loosely pulvinate, flaccid "hydric" form and the more densely pulvinate "montane" form occur in the Interior Highlands.

12. GRIMMIACEAE

1. *Grimmia* Hedw.

Plants in green to blackish or brownish green cushions, mats, or dense tufts, often appearing whitish because of hyaline leaf apices; leaves crowded, usually imbricate when dry, erect-ascending, spreading, or recurved when moist, lanceolate, often from an oblong to ovate base, plane, concave, carinate, or caniculate; margins plane or revolute; costa sub-percurrent to excurrent, flat or terete in cross section, often terminating in a hyaline, smooth to spinulose hair-point; upper leaf-cells rounded-quadrate, unistratose to bistratose, papillose; lower leaf-cells smooth, quadrate to rectangular; cell walls thin and smooth to thick and sinuose; capsule symmetric, immersed to exserted upon a straight to arcuate seta; peristome single, composed of 16 perforate or cleft teeth; calyptra cucullate or mitrate; with rare exceptions all taxa grow on rocks.

A difficult genus in need of critical revision. The following key is based upon a key to North American species of *Grimmia* by Sayre (1952).

a. Upper leaves (excluding perichaetial) without hair-points .... b
a. Upper leaves with hair-points (may be inconspicuous or absent in some leaves) .... e
  b. Apex of some or all of the upper leaves obtuse or rounded .... 2. *G. alpicola*
  b. Apex of upper leaves acuminate or acute c
c. Leaves less than 1.5 mm long .... 1. *G. apocarpa*
c. Leaves 1.5–3.0 mm long .... d
  d. Peristome teeth red, pointed; capsule ovate; most leaves ovate-lanceolate .... 2. *G. alpicola*
  d. Peristome teeth pale, truncated; capsule oblong; most leaves linear-lanceolate .... 1. *G. apocarpa*
e. Margins of leaves inrolled in some part of the leaf; apex often drawn out to a channeled acumen .... f

e. Margin of leaves plane or erect, or one or both recurved; apex not channeled .... g
f. Seta curved; costa terete, hair-point spinose .... 11. *G. olneyi*
f. Seta straight; costa mostly flat, hair-point nearly smooth .... 9. *G. ovalis*
g. Leaves broader above the middle or oblong, abruptly acuminate; hair-point 1½ times the length of upper leaves .... 3. *G. wrightii*
g. Leaves broader below the middle, gradually acuminate or acute; hair-point shorter .... h
h. Leaf-cells mostly unistatose, large and clear .... 4. *G. rauei*
h. Leaf-cells mostly bistratose, small and obscure i
i. Costa flat; leaf apex usually acute; capsule exserted .... 5. *G. laevigata*
i. Costa terete; apex usually acuminate; capsule immersed .... j
j. Leaves almost lingulate, ending in a long denticulate hair-point to ¾ the length of leaf .... 10. *G. pulvinata*
j. Leaves lanceolate to ovate-lanceolate, hair-point shorter, less than ⅓ the length of leaf .... k
k. Most mature leaves 2 mm long or longer l
k. Most mature leaves 1–1.5 mm long .... n
l. Both margins equally and distinctly revolute .... m
l. Margins plane or only one revolute and the other slightly recurved below .. 8. *G. arizonae*
m. Leaves narrowly acuminate from ovate base; costa forming about ¼ of the leaf base; basal leaf-cells rectangular, thick-walled and sinuose; alar cells hyaline .... 7. *G. pilifera*
m. Leaves lanceolate, some acute; lower leaf-cells 2:1; alar cells not hyaline .. 1. *G. apocarpa*
n. Plants not filiform; alar cells not differentiated; most leaves with both margins revolute .... 1. *G. apocarpa*
n. Plants filiform; alar cells differentiated, usually hyaline; some or all leaves with one revolute margin and the other incurved .... 6. *G. teretinervis*

1. *Grimmia apocarpa* Hedw.

Schistidium apocarpum (Hedw.) B.S.G.

This is a highly polymorphic taxon, and there is a great deal of confusion regarding not only the status of subspecific taxa but with the next taxon. Varieties have been described that may be local or general environmental modifications. Nyholm (1956: 145) has suggested what is perhaps the only answer to this perplexing group, cultivation experiments. Five varieties are known, reported from, or may occur in the Interior Highlands and can be separated by the following differences.

a. Upper leaves (excluding the perichaetial) not piliferous .... b
a. Upper leaves piliferous c
b. Leaves under 1.5 mm long .... 1b. *G. apocarpa* var. *dupretii*
b. Leaves 1.5–3 mm long .... 1e. *G. apocarpa* var. *obscuriviridis*
c. Mature leaves 2 mm long or longer .... 1c. *G. apocarpa* var. *stricta*
c. Mature leaves 1–1.5 mm long .... d
d. Plants dark green or black; capsule oblong .... 1a. *G. apocarpa* var. *apocarpa*
d. Plants bright green; capsule globose .... 1d. *G. apocarpa* var. *conferta*

1a. *Grimmia apocarpa* var. *apocarpa*

Common throughout the Interior Highlands; on dry, exposed rocks, usually on but not limited to calcareous types.

1b. *Grimmia apocarpa* var. *dupretii* (Thér.) Sayre

Rare, Springfield Plateau; on flat exposed limestone.

Known only from Roaring River State Park, Barry Co., Missouri. This variety has recently been placed in the species *Grimmia alpicola* by Crum (1971: 168).

1c. *Grimmia apocarpa* var. *stricta* (Turn.) Hook. & Tayl.

Grimmia apocarpa Hedw. var. *gracilis* (Schleich.) Web. & Mohr

Reported from Shannon Co., Missouri, by Gier (1955*a*: 35).

1d. *Grimmia apocarpa* var. *conferta* (Funck) Spreng.

Uncommon, Boston Mtns.; on rocks.

1e. *Grimmia apocarpa* var. *obscuriviridis* Crum

Not known from Interior Highlands, but Sayre (personal communication) believes that it should be.

2. *Grimmia alpicola* Sw. *ex* Hedw.

Grimmia apocarpa var. *alpicola* (Hedw.) Hartm.
Schistidium alpicola (Hedw.) Limpr.

Common throughout the Interior Highlands; on exposed rocks, especially limestone, along edges of creeks and gullies.

May be confused with the preceding taxa. However, when fertile they may be separated by the shape of the capsule. *Grimmia alpicola* has a more or less globular capsule, while the capsule of *G. apocarpa* is more distinctly ovoid to ellipsoid.

3. *Grimmia wrightii* (Sull.) Aust.

Reported from Missouri by Sayre (personal communication).

4. *Grimmia raui* Aust.

Reported from Missouri by Sayre (personal communication).

5. *Grimmia laevigata* (Brid.) Brid.

Very common throughout Interior Highlands; as a pioneer on exposed rocks. Often locally abundant.

May be recognized by its decurrent, flat, spinulose, hyaline apex.

6. *Grimmia teretinervis* Limpr.

Rare, Springfield Plateau; on open limestone.

Known only from Greene Co., Missouri, on bluffs above James River just below Lake Springfield Dam.

7. *Grimmia pilifera* P. Beauv.

Common throughout the Interior Highlands; as a pioneer species on exposed to shaded rocks of all types, rarely on decaying wood. Often locally abundant.

8. *Grimmia arizonae* Ren. & Card.

Sayre (personal communication) reports that this species occurs in Oklahoma. It may, therefore, be present in the Interior Highlands.

9. *Grimmia ovalis* (Hedw.) Lindb.

Rare, Salem Plateau; on rocks.

10. *Grimmia pulvinata* (Hedw.) Sm. *ex* Sm. & Sowerby

Uncommon, Ouachita Mtns., Prairie Plains, Springfield Plateau; on dry, open flat sandstone exposures and occasionally on brick walls. Apparently most frequent in the Prairie-border regions of the Interior Highlands.

11. *Grimmia olneyi* Sull.

Rare, St. Francois Mtns.; on non-calcareous rocks in exposed sunny places.

Excluded taxa:
Rhacomitrium aciculare (Hedw.) Brid.—The collection from McCurtain County by Sharp (1930) is *Grimmia alpicola.*

13. EPHEMERACEAE

1. *Ephemerum* Hampe

Small inconspicuous plants, stems almost absent, growing from persistent protonema; leaves costate or ecostate, lanceolate; margins strongly toothed to serrate; capsule cleistocarpous, ovoid, apiculate; calyptra campanulate, 0.2 mm or more in over-all length.

The following treatment is based upon a study of this family by Bryan and Anderson (1957).

a. Cells in the middle third of leaf lamina smooth, in distinct diagonal rows from costa to margin .... 3. *E. cohaerens*
a. Cells of the leaf lamina papillose above, usually conspicuously so; if smooth, not in diagonal rows .... b
  b. Spines of upper leaves mostly recurved at an angle of 45° or more; leaves usually narrowly linear-lanceolate; lamina papillose or smooth above; leaf-cells at middle of leaf about 4–8:1 .... 2. *E. spinulosum*
  b. Upper leaves almost entire to strongly toothed; most of the teeth extending at an angle of less than 45°; lamina conspicuously papillose above; leaf-cells at middle of leaf less than 4:1 c
c. Upper leaves lanceolate, without shoulder .... 1a. *E. crassinervium* var. *crassinervium*
c. Upper leaves broadly lanceolate-subulate, with slight to prominent shoulder .... 1b. *E. crassinervium* var. *texanum*

1a. *Ephemerum crassinervium* (Schwaegr.) Hampe var. *crassinervium*

Rare, eastern Salem Plateau; on sandstone. Known only by a single collection from Jefferson Co., Missouri, made by Barkley, Oct. 23, 1936.

The distinguishing characters of this taxon are its long-lanceolate upper leaves that reach 1.5 mm in length and 0.2 mm in maximum width, margins serrate in upper ⅔, dense areolation in upper half, and a strong costa running from base to apex (Bryan & Anderson, 1957).

1b. *Ephemerum crassinervium* var. *texanum* (Grout) Bryan & Anderson.

Reported from Boston Mtns., Conway Co., Arkansas, by Moore (1965).

2. *Ephemerum spinulosum* Bruch & Schimp. *ex* Schimp.

Rare, western Springfield Plateau; on soil, edge of creek. Known only from vicinity of Horse Creek, 2 miles south of Olympia on County Rd. A, Cedar Co., Missouri, *Ireland 3273* (US).

Plants of this taxon may be distinguished from the preceding taxa by the presence of unusually abundant and persistent protonema at the time leafy gametophytes mature (Bryan & Anderson, 1957).

3. *Ephemerum cohaerens* (Hedw.) Hampe

Rare, Salem Plateau; on moist, shaded, sandy soil. Known only from vicinity of Blue Springs, edge of Jack's Fork River, Shannon Co., Sect. 31-32, T. 28 N., R. 6 W., *Redfearn 7736*.

14. FUNARIACEAE

Plants annual, sometimes biennial, in low, light green, loose to clustered tufts, characteristically growing in open areas on bare soil or soil sparcely covered by other plants; stems erect; upper leaves closely clustered, concave, costate, often serrate above; leaf-cells large, parenchymatous, *ca.* 20–30 μ in width, rhombic-to oblong-hexagonal to rectangular, lax, border weakly defined; capsules immersed to exserted on long setae, globose to pyriform, symmetric to strongly inclined and asymmetric; peristome when present composed of an outer row of 16 reddish to brownish red teeth and an inner row of 16 yellowish, often rudimentary segments.

a. Capsules immersed; peristome absent .... b
a. Capsules emergent to exserted; peristome present or absent c
b. Capsule functionally inoperculate; exothecial cells not strongly collenchymatous .... 1. *Physcomitriella*
b. Capsule operculate, dehiscing along the equatorial line; exothecial cells strongly collenchymatous .... 2. *Aphagnorhegma*
c. Capsule unsymmetric and curved .... 5. *Funaria*
c. Capsule symmetric, straight .... d
d. Seta short, about length of capsule; calyptra 4-angled .... 4. *Pyramidula*
d. Seta longer than capsule; calyptra symmetrically rostrate .... 3. *Physcomitrium*

1. *Physcomitriella* B.S.G.

1. *Physcomitriella patens* (Hedw.) B.S.G.

Aphanorhegma patens (Hedw.) Lindb.

Small, inconspicuous plants with immersed, inoperculate capsules; leaves erect-spreading, lanceolate, costate; margins serrate; median leaf-cells oblong-rectangular, 3–4 : 1; marginal cells longer.

Rare, Salem Plateau; on open soil. Matures in fall and, because of small size, commonly overlooked.

This taxon is closely related to the next from which it may be separated by its inoperculate capsules with exothecial cells not conspicuously collenchymatous. Hybrids with *Physcomitrium pyriforme* have been reported by Bryan (1957).

2. *Aphanorhegma* Sull.

1. *Aphanorhegma serratum* (Hook. *f.* & Wils. *ex* Drumm.) Sull.

Similar to *Physcomitriella patens* except that capsule is dehiscent along equatorial line and exothecial cells are strongly collenchymatous.

Uncommon, Salem and Springfield Plateaus; on open to shaded moist soil. Plants with mature capsules may be found from late fall to early winter.

3. *Physcomitrium* (Brid.) Fürnr.

1. *Physcomitrium pyriforme* (Brid.) De Not.

Small, light green, tufted plants; leaves oblong-oblanceolate to oblong-lanceolate, contorted when dry, spreading when moist; margins serrate above; capsules erect, globose-pyriform when fresh, turbinate and constricted below mouth when dry, exserted on setae 5–15 mm long.

Very common through the Interior Highlands; on soil in pastures, lawns, and waste places.

Physcomitrium collenchymatum Gier has been reported from Clay County, Missouri, just north of the Missouri River (Gier, 1955*b*: 330). This taxon may be collected in the Interior Highlands and may be distinguished from *P. pyriforme* by its smaller size and the extremely flared condition of the capsule when dry and empty (Crum & Anderson, 1964).

4. *Pyramidula* Brid.

1. *Pyramidula tetragona* (Brid.) Brid.

Small, loosely tufted, short-stemmed plants; capsule erect, symmetric, globose-pyriform, barely exserted; calyptra 4-angled, entirely covering the capsule.

Rare, southwestern edge of Interior Highlands; on sandstone. Known only from Muskogee Co., Oklahoma, from a collection reported by Little (1936: 12).

5. *Funaria* Hedw.

Plants in loose to dense tufts, upper leaves often forming bud-like clusters; leaves entire or serrate; setae long; capsule with conspicuous neck, elongated-pyriform, strongly unsymmetric to arcuate; annulus present or absent; peristome in two rows of 16 teeth each, outer row reddish to brownish red and somewhat twisted to right, inner row yellowish, often rudimentary.

a. Annulus present, conspicuous .... b
a. Annulus absent .... d
  b. Segments of inner peristome obtuse, less than ½ length of outer teeth; spores 20–30 μ in diameter .... 2. *F. flavicans*
  b. Segments of inner peristome lanceolate, slenderly pointed, at least ¾ length of outer teeth; spores 12–18 μ in diameter c
c. Capsules horizontal to pendent, turgid, strongly arcuate .... 1a. *F. hygrometrica* var. *hygrometrica*
c. Capsule slender, merely inclined, less arcuate .... 1b. *F. hygrometrica* var. *calvescens*
  d. Leaves entire, costa excurrent .... 3. *F. americana*
  d. Leaves serrate, costa ending below apex in most leaves .... 4. *F. serrata*

1a. *Funaria hygrometrica* Hedw. var. *hygrometrica*

Common throughout Interior Highlands; on bare soil of waste places, limestone glades, around areas of recently burned trash.

1b. *Funaria hygrometrica* var. *calvescens* (Schwaegr.) Mont.

Rare, eastern Salem Plateau; on moist soil.

2. *Funaria flavicans* Michx.

Common throughout Interior Highlands; on moist, shaded to exposed soil and limestone, piles of ashes, and on rocks along edges of creeks.

3. *Funaria americana* Lindb.

Rare, Springfield Plateau; on bare soil.

4. *Funaria serrata* Brid.

Rare, Boston and Ouachita Mtns.; on moist bare soil.

15. TETRAPHIDACEAE

1. *Tetraphis pellucida* Hedw.

Plants small to medium in size, scattered to tufted, bright green to brownish green; stems erect, simple or sparingly branched; leaves ovate to ovate-lanceolate, apex acute; margins plane, entire; costa ending in apex or below; median leaf-cells isodiametric, rounded-hexagonal, incrassate, capsule erect, symmetrical, ovoid to cylindrical; operculum conic; peristome single, teeth 4; shoots frequently bearing terminal gemmiferous cups, formed of 4–5 broadly cordate bracts, containing lenticular gemmae.

Common, Boston and Ouachita Mtns., Ozark Hills, Prairie Plains, Salem and Springfield Plateaus; on moist shaded sandstone, rarely on soil at bases of sandstone boulders and bluffs.

When sporophytes are present, a peristome composed of only four teeth is distinctive. Sterile forms may be confused with *Mnium stellare*; however, that species has serrate leaf margins.

16. BRYACEAE

Plants in loose to dense tufts, dark green, yellow-green to silvery, often tinged with red; leaves ovate-lanceolate, obovate-spatulate, to narrowly linear-setaceous, frequently larger and crowded into a rosette at the stem apex; margins smooth to serrate, often bordered with elongated cells; costa strong, ending below apex to percurrent or excurrent; cells smooth, thin- to thick-walled, hexagonal, rhomboidal, or linear near the apex; sporophyte terminal; capsule ovate to cylindrical with short or long neck, erect, inclined to pendulous, exserted upon a long seta; peristome double, teeth 16, segments alternating with teeth, often with cilia.

a. Plants whitish-green to silvery in color .... b
a. Plants green, yellow-green, to reddish green c

- b. Plants whitish green, growing in moist habitats; leaves loosely imbricate, lanceolate to linear lanceolate .... 1. *Pohlia*
- b. Plants silvery, growing in drier habitats; leaves closely imbricate, broadly ovate to obovate .... 3. *Bryum*

c. Erect shoots with terminal rosette of large, obovate-spatulate, serrate leaves; shoots rising from stolons .... 4. *Rhodobryum*

c. Plants not as above .... d

- d. Leaves very narrowly linear-setaceous; costa broad and occupying most of the terminal end of leaf .... 2. *Leptobryum*
- d. Leaves wider, ovate, ovate-lanceolate to obovate; costa narrower and not filling the upper part of the leaf .... e

e. Margins serrate in upper ¼ of leaf, if denticulate, upper leaf cells 8–12:1 and leaves clearly imbricate on stem; border of elongated cells not well developed; costa sub-percurrent to excurrent .... 1. *Pohlia*

e. Margins entire to only denticulate in upper ¼ of leaf; border of elongate cells often well developed; costa sub-percurrent to excurrent .... 3. *Bryum*

1. *Pohlia* Hedw.

Loosely to densely tufted plants, yellow-green to whitish green in color; leaves closely imbricate to distant on stem, narrowly lanceolate to ovate-lanceolate, denticulate to serrate near apex; costa ending below apex to percurrent; median leaf-cells rhomboidal-linear or rhombic-hexagonal, smooth.

a. Leaves closely imbricate c

a. Leaves distant on stem .... b

- b. Elongate, twisted-vermiform gemmae present .... 1. *P. annotina* var. *loeskei*
- b. Gemmae absent .... 4. *P. wahlenbergii*

c. Leaves denticulate near apex; upper leaf-cells 8–12:1; branches filiform .. 2. *P. filiformis*

c. Leaves serrate near apex; upper leaf-cells shorter, 5–7:1; branches not filiform .. 3. *P. nutans*

1. *Pohlia annotina* (Hedw.) Lindb. var. *loeskei* Crum, Steere & Anderson

Rare, Springfield Plateau; on moist shaded sandstone or sandy soil, along creeks and streams.

The presence of elongated, twisted-vermiform gemmae distinguishes this taxon from other Pohlias in the Interior Highlands.

2. *Pohlia filiformis* (Dicks.) Andr. var. *filiformis*

Rare, Springfield Plateau of western Missouri; on sandstone outcrops, near Cedar Springs in Cedar County (*Ireland 3462*) and at Lichen Glade in St. Clair County (*Redfearn 27333*).

3. *Pohlia nutans* (Hedw.) Lindb. var. *nutans*

Very common throughout the Interior Highlands; a weedy species growing on rocky soil, rock ledges and crevices, and occasionally around bases of trees. Frequently mixed with other bryophytes.

Forms having three cilia have been given varietal status as *Pohlia nutans* var. *tricilata* (Jenn.) Jenn. by some authors. However, this practice is not followed in this treatment because the three-ciliate forms appear to be randomly dispersed among the two-ciliate forms.

4. *Pohlia wahlenbergii* (Web. & Mohr) Andr.

Common throughout the Interior Highlands; on moist soil and rocks, edges of creeks and streams.

2. *Leptobryum* (B.S.G.) Wils.

1. *Leptobryum pyriforme* (Hedw.) Wils.

Plants in loose to dense, yellow-green tufts; leaves narrowly linear-setaceous; costa broad; capsule cylindrical, inclined to pendent, with pronounced neck, exserted upon a long seta, light to dark brown, lustrous.

Uncommon, Prairie Plains, Salem and Springfield Plateaus; on moist substrates, especially sandstone or sandy soil, occasionally on decaying logs or stumps near water.

Sterile collections may be confused with *Ditrichum* or *Dicranella*. The broad costa and long linear-rectangular to fusiform basal leaf-cells serve to distinguish *L. pyriforme* from these taxa.

3. *Bryum* Hedw.

Plants loose to densely tufted, silvery, yellow to dark or reddish green in color; leaves ovate, obovate, to lanceolate, often distinctly bordered by elongated cells; margins entire to denticulate near apex, plane or recurved; costa ending below apex to strongly excurrent; upper leaf-cells short-rhomboidal to rhomboidal-hexagonal; lower cells rectangular; capsule exserted on a short to long seta, cylindrical, clavate, pyriform to oval, neck often well differentiated, inclined to pendulous.

a. Plants silvery in color	2. *B. argenteum*
a. Plant not silvery in color	b
b. Leaves obtuse, rounded-obtuse, to sub-acute; costa not excurrent	c
b. Leaves acute to acuminate; costa often excurrent	e
c. Leaves decurrent	d
c. Leaves not decurrent	9. *B. mniatum*
d. Leaf cells thin-walled	12. *B. tortifolium*
d. Leaf cells thick-walled, at least at corners	7. *B. gemmiparum*
e. Plants small with regularly to irregularly sphaerical gemmae attached to rhizoids	f
e. Gemmae not present on rhizoids	g
f. Rhizoids usually deep violet in color	11. *B. ruderale*
f. Rhizoids pale yellowish to brownish, but not violet in color	8. *B. klinggraefii*
g. Costa percurrent to slightly excurrent	h
g. Costa long-excurrent or upper cells forming a cuspidate apex	i
h. Leaves to 2.5 mm[4] or more long, strongly bordered; plants often dark reddish purple in color	10. *B. pseudotriquetrum*
h. Leaves 1 mm or less long, not distinctly bordered	3. *B. bicolor*
i. Leaves obovate to obovate-spatulate, usually spirally twisted around stem	5. *B. capillare*
i. Leaves ovate to long-lanceolate, not spirally twisted about stem	j
j. Inner peristome with rudimentary, imperfectly developed cilia	k
j. Inner peristome with well developed cilia	l
k. Inner peristome adherent to outer peristome by transverse ridges	1. *B. angustirete*

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[4] Occasional aquatic forms may have much smaller leaves with the border less well developed.

k. Inner peristome not adherent to outer peristome .... 13. *B. uliginosum*
  l. Infloresense synoicous; upper leaf-cells 3–5 : 1 .... 6. *B. creberrimum*
  l. Infloresense dioicous; upper leaf-cells 6–7 : 1 .... 4. *B. caespiticium*

1. *Bryum angustirete* Kindb. *ex* Mac.

Bryum pendulum (Hornsch.) Schimp.

Rare, Salem Plateau; on soil.

Without capsules, separation of this taxon from other taxa of *Bryum* is not possible. However, when capsules are present, the lack of well developed cilia on the inner peristome and the adherence of the inner peristome to the outer by transverse ridges is distinctive.

2. *Bryum argenteum* Hedw.

Two varieties may be encountered in the Interior Highlands and may be separated as follows:

Costa ending below apex .... 2a. *B. argenteum* var. *argenteum*
Costa percurrent to excurrent .... 2b. *B. argenteum* var. *lanatum*

2a. *Bryum argenteum* var. *argenteum*

Common throughout the Interior Highlands; on soil of disturbed habitats, crevices of sidewalks, cedar shingle roofs, rarely bases of trees or on rocks.

2b. *Bryum argenteum* var. *lanatum* (P. Beauv.) Hampe

Reported from Greene and St. Louis Counties, Missouri, by Gier (1955*a*: 32). This variety is not recognized by many authors (Nyholm, 1958: 252).

3. *Bryum bicolor* Dicks.

Uncommon, throughout the Interior Highlands; on soil.

This species is quite small, usually less than 0.5 mm tall, gregarious, and frequently mixed with other mosses. Axillary bulbiform gemmae, when present, are distinctive.

4. *Bryum caespiticium* Hedw.

Uncommon, Salem and Springfield Plateaus; on sterile soil, occasionally on rocks.

Sterile plants are difficult to identify. Various authors have attempted to distinguish this taxon on the basis of leaf border and shape of leaf cells. However, these characters are notoriously variable in *Bryum* and may be misleading rather than definitive.

5. *Bryum capillare* Hedw.

Common, throughout the Interior Highlands; on soil, wooded areas, rocks, ledges, pastures, and waste places. Occasionally abundant in crevices of vertical rock exposures.

The soft, ovate-obovate leaves that are spirally twisted about the stem serve to distinguish this species from other taxa of *Bryum* in the Interior Highlands.

6. *Bryum creberrimum* Tayl.

Bryum cuspidatum (B.S.G.) Schimp.

Common, Salem and Springfield Plateaus; on open to shaded soil and rocks. Sterile collections are difficult to identify with certainty. When fertile, the synoicous inflorescence, lanceolate leaves with short (3–5 : 1) upper cells, and excurrent costa, and peristome with well developed cilia are distinctive for this taxon.

7. *Bryum gemmiparum* De Not.

Uncommon, Boston Mtns., Salem and Springfield Plateaus; forming dense cushions on calcareous rocks subject to inundation or seepage.

The calciphile nature of this species combined with its obtuse to sub-acute leaves serve to separate it from all taxa except *Bryum tortifolium.* The latter species may be distinguished by the presence of distinctly rounded leaf apices and thin-walled upper leaf-cells.

8. *Bryum klinggraefii* Schimp. *in* Klinggr.

Apparently rare, eastern Salem Plateau; on bare or disturbed soil, often associated with *Physcomitrium, Bryum ruderale* or *Physcomitriella patens,* on mud at margins of ponds and reservoirs.

Reported by Crundwell and Nyholm (1964: 615) from St. Louis County, Missouri, near Creve Coeur Lake from a collection by N.L.T. Nelson, 1906 (as *Physcomitrium rostellatum* Kindb.)

9. *Bryum miniatum* Lesq.

Rare, St. Francois Mtns.; in crevice of felsite rocks, edge of creek. Known only from Johnson Shut-In State Park, Reynold County, Missouri (*Redfearn 13884*).

The taxonomic status of this species is open to question. It is very similar to and may be conspecific with *Bryum muehlenbeckii* B.S.G.

10. *Bryum pseudotriquetrum* (Hedw.) Gaertn., Meyer & Schreb.

Bryum bimum Schreb.

Very common throughout the Interior Highlands; on soil and rock exposures, particularly abundant in areas subject to seepage, occasionally around bases of trees.

11. *Bryum ruderale* Crundw. & Nyh.

Apparently rare; mixed with *Physcomitrium rostellatum* and *Bryum klinggraefii* (see discussion under latter species).

12. *Bryum tortifolium* Funck *ex* Brid.

Rare, Salem and Springfield Plateaus; on rocks in swiftly flowing creeks.

This species can be confused with *Bryum gemmiparum* (see discussion under that species).

13. *Bryum uliginosum* (Brid.) B.S.G.

Bryum cernum (Hedw.) B.S.G.

Rare, eastern Salem Plateau; on rocky soil of wooded slopes.

4. *Rhodobryum* (Schimp.) Hampe

1. *Rhodobryum roseum* (Hedw.) Limpr.

Large plants with erect branches arising from a stolon; leaves in a large terminal rosette, loosely imbricate when dry, widely spreading when moist, obovate-spatulate, serrate; upper cells regularly oblong-hexagonal, walls thick and pitted; not observed fruiting in the Interior Highlands.

Common throughout the Interior Highlands; on calcareous soil of rock ledges, rarely at the bases of trees.

17. MNIACEAE

1. *Mnium* Hedw.

Plants light to dark green, loosely to densely tufted, sterile stems often prostrate; leaves complanate, ovate, rounded-ovate, obovate to ovate-lanceolate, frequently decurrent, entire to serrate, usually with a border of elongated cells, costate, frequently crisped when dry; leaf-cells hexagonal, often collenchymatous; inflorescence terminal, synoicous or dioicous; capsule ovate to cylindrical, horizontal to pendulous, exserted upon a long seta; peristome double.

a. Leaves distinctly bordered by elongated cells .... b
a. Leaves not distinctly bordered by elongated cells .... 1. *M. stellare*
  b. Margins of leaves serrate; if entire, bases not cuneate c
  b. Margins of leaf entire, bases cuneate .... 8. *M. punctatum*
c. Marginal teeth double .... d
c. Marginal teeth single .... g
  d. Leaves narrowly elliptic-ovate to ovate-lanceolate; costa toothed on back near apex, not reaching apex of leaves .... 2. *M. hornum*
  d. Leaves ovate lanceolate; costa not toothed on back, reaching apex in most leaves .. f
f. Leaf-cells averaging 25 μ in diameter, collenchymatous, tending to be arranged in longitudinal rows; synoicous or paroicous .... 4. *M. marginatum*
f. Leaf-cells averaging less than 20 μ in diameter, walls uniformly thickened; dioicous .... 3. *M. orthorrhynchum*
  g. Leaves serrate nearly to base .... h
  g. Leaves serrate only in upper ½ or ⅔ .... 5. *M. cuspidatum*
h. Teeth of leaves 1–3-cells-long; apex obtuse or mucronate; dioicous .... 7. *M. affine*
h. Teeth of leaves one-cell-long, rarely more; apex acute to acuminate; synoicous .. 6. *M. medium*

1. *Mnium stellare* Hedw.

Uncommon, Boston Mtns., Ozark Hills, Salem and Springfield Plateaus; on shaded soil and rocks, rarely at bases of trees or on decaying wood.

The serrations along the border of the leaf are often obscure and a faint border of elongated cells may be occasionally noted. Sterile forms of *Tetraphis pellucida* may be confused with this taxon. However, *T. pellucida* has rounded leaf cells and entire leaf margins.

2. *Mnium hornum* Hedw.

Reported from St. Louis County, Missouri, by Andrews (*in* Grout, 1933). The report from Jackson County, Illinois, by Redfearn (1966: 507) is an error as the collection (*Redfearn 18789*) is *Mnium marginatum.*

3. *Mnium orthorrhynchum* Brid.

Uncommon, Boston Mtns., Salem Plateau; on shaded moist limestone and sandstone exposures.

Plants of this species are quite small and easily overlooked. Consequently, its distribution is probably wider than collection records indicate. This taxon may be confused with the next. When fertile, its dioicous condition serves to distinguish it from *Mnium marginatum.* Sterile plants are more difficult to separate. However, the leaf cells of *M. marginatum* are generally larger (<25 μ in diameter) and collenchymatous, while the cells of *M. orthorrhynchum* are smaller (some do average <20 μ in diameter) and thin-walled with little thickening at the corners.

4. *Mnium marginatum* (With.) Brid. *ex* P. Beauv.

Mnium serratum Schrad. *ex* Brid.

Common, Boston Mtns., Ozark Hills, Salem and Springfield Plateaus; on shaded, moist rocks, particularly in crevices and undersides of overhanging ledges, occasionally on soil or bases of shrubs or trees.

For distinctions from *Mnium orthorrhynchum*, see notes under that taxon.

5. *Mnium cuspidatum* Hedw.

Very common throughout the Interior Highlands; on moist, shaded soil and rocks.

An easily recognizable taxon with rounded, ovate to obovate leaves that are strongly decurrent and serrate only in the upper ½–⅔.

6. *Mnium medium* B.S.G.

Reported from Conway County, Arkansas, by Moore (1965: 32).

7. *Mnium affine* Bland. *ex* Funck

This taxon shows considerable variability and several varieties have been suggested. Of these, only the variety *rugicum* seems worthy of recognition in the Interior Highlands.

a. Leaves decurrent; leaf cells to 50 μ in length .... 7a. *M. affine* var. *affine*
a. Leaves not decurrent; leaf cells often exceeding 70 μ in length .. 7b. *M. affine* var. *rugicum*

7a. *Mnium affine* var. *affine*

Very common throughout the Interior Highlands; on shaded soil and rocks.

May be confused only with *Mnium medium* from which it may be separated by the features noted in the key above.

7b. *Mnium affine* var. *rugicum* (Lour.) B.S.G.

Mnium rugicum Laur.

Rare, Salem and Springfield Plateaus; on shaded rocks and soil beside creeks and streams.

The taxonomic validity of this taxon is questioned by many. However, it is distinct in its size and form and should be recognized, especially since there is not any evidence as to the basis of its remarkable differences. These differences may be due to environmntal or cytological factors, or both. Clearly, further study is needed.

8. *Mnium punctatum* Hedw.

Common throughout the Interior Highlands; on rocks and decaying wood in moist, shaded areas, particularly in rock crevices and beside streams and gullies.

18. AULACOMNIACEAE

1. *Aulacomnium* Schwaegr.

Plants in dense to loose tufts, pale to blackish green in color, often tomentose at base; leaves ovate to lanceolate, coarsely toothed to denticulate above; costa stout at base, ending below the apex; upper leaf-cells small (7–18 μ), collenchymatous with single papillae on both surfaces; lower leaf-cells larger, elongate, to 30 μ long, walls incrassate; fusiform brood-bodies often present on pseudopodia; capsules on twisted seta, 1–1.5 cm long, suberect, longitudinally striate; operculum beaked; peristome double.

a. Leaves ovate, coarsely serrate above .... 1. A. *heterostichum*
a. Leaves lanceolate, denticulate above .... 2. A. *palustre*

1. *Aulacomnium heterostichum* (Hedw.) B.S.G.

Common throughout the Interior Highlands; on moist, shaded soil banks and rock ledges. Often mixed with *Mnium affine*, *M. cuspidatum*, or *Bartramia pomiformis*.

2. *Aulacomnium palustre* (Hedw.) Schwaegr.

Uncommon throughout the Interior Highlands; often very abundant on moist, dripping sandstone ledges and at bases of bluffs or on soil subject to a great deal of seepage. Not infrequently mixed with *Sphagnum* in bogs.

19. BARTRAMIACEAE

Plants yellowish green to bright green, in loose to dense tufts, densely tomentose below; leaves linear-lanceolate to ovate-lanceolate, costate; cells papillose by projection of end-walls; capsule subglobose to ovoid, furrowed when dry, inclined or cernuous, exserted upon a long seta; peristome double.

a. Plants in large, soft tufts; leaves 5–6 mm long, linear- to elongate-lanceolate, subulate, flexuous from an ovate, more or less clasping base; margins usually strongly denticulate to sharply serrate above .... 1. *Bartramia*
a. Plants in coarse, dense tufts; leaves 1.5–2 mm long, linear-lanceolate to ovate-lanceolate, not flexuous; serrate but not denticulate above .... 2. *Philonotis*

1. *Bartramia* Hedw.

1. *Bartramia pomiformis* Hedw.

Soft tufted mosses, bright green to bluish green; leaves 5–6 mm long, elongate-lanceolate, subulate, flexuous from an ovate, more or less clasping base; margins revolute to apex, strongly denticulate to sharply serrate above, bistratose distally; upper leaf-cells thick-walled and short-rectangular, papillose on both surfaces; basal cells linear to oblong, smooth; capsule exserted on seta 1–2 cm long, inclined or cernuous, globose to ovoid, deeply furrowed when dry, reddish to dark chestnut brown; peristome double.

Common throughout the Interior Highlands; on moist, shaded soil banks and rock ledges. Often mixed with *Aulacomnium heterostichum.*

2. *Philonotis* Brid.

Plants usually densely tufted, bright to light green, occasionally pale or glaucous, branches whorled and subtending perigonia, stems densely tomentose below; leaves to 2 mm long, narrowly triangular-lanceolate to ovate-lanceolate, apex acuminate; margins plane or revolute, singly or doubly serrate; costa percurrent to long-excurrent; upper leaf-cells oblong to linear, papillose at upper or lower ends or both; basal leaf cells larger, smooth or papillose; autoicous or dioicous, perigonia gemmiform or discoid; seta long; capsule subglobose to ovoid, inclined to cernuous, reddish-brown, longitudinally furrowed; peristome double.

a. Costa percurrent to slightly excurrent; leaves distinctly papillose; apex acuminate to acute .... b
a. Costa ending below apex; leaves weakly papillose; apex blunt or obtuse .... 1. *P. gracillima*
  b. Papillae at lower end of cells .... e
  b. Papillae at upper end of cells, occasionally at both ends c
c. Perigonia gemmiform; leaves narrowly lanceolate to triangular-lanceolate; leaf-cells linear to rectangular; basal cells not noticeably shorter and wider .... 2. *P. longiseta*
c. Perigonia discoid; leaves ovate-lanceolate to triangular-lanceolate; leaf-cells linear to oblong; basal cells distinctly larger and broader than median leaf-cells .... d
  d. Leaves ovate-lanceolate; median leaf-cells oblong to linear, weakly papillose, papillae occasionally at both ends of cells, not forming noticeable parallel rows; basal cells tending to be smooth .... 4. *P. muehlenbergii*
  d. Leaves ovate-lanceolate to triangular-lanceolate; median leaf-cells mostly linear, distinctly papillose and arranged in parallel rows; basal cells usually papillose .... f
e. Margins of leaves singly serrate, not recurved .... 6. *P. caespitosa*
e. Margins of leaves doubly serrate, recurved above .... 7. *P. fontana*
  f. Costa percurrent or shortly excurrent; leaves ovate-lanceolate to triangular-lanceolate .... 3. *P. marchica*
  f. Costa long and slenderly excurrent; leaves often slenderly lanceolate .... 5. *P. capillaris*

1. *Philonotis gracillima* Ångstr.

Rare, Ouachita Mtns., eastern Salem Plateau; on shale and sandstone.

2. *Philonotis longiseta* (Michx.) Britt. var. *longiseta*

Uncommon, Boston and Ouachita Mtns., Salem and Springfield Plateaus; on shaded sandy soil, sandstone, dolomite, or shale, usually near flowing water.

3. *Philonotis marchica* (Hedw.) Brid.

Common throughout the Interior Highlands; on rocks and soil, mostly calcareous, along banks of gullies and streams.

This taxon is difficult to distinguish from the next. Transitional forms may be encountered making assignment to either difficult if not impossible. Further research is needed to resolve the difficulties in this and related taxa.

4. *Philonotis muehlenbergii* (Schwaegr.) Brid.

Uncommon throughout the Interior Highlands; on moist soil and rocks along gullies, creeks, and streams. Easily confused with *Philonotis marchica.*

5. *Philonotis capillaris* Lindb.

Rare, eastern Salem Plateau, known only from Pickle Springs in Ste. Genevieve County, Missouri; on shaded sandstone ledge.

6. *Philonotis caespitosa* Jur. var. *caespitosa*

Reported from Conway County, Arkansas, by Moore (1965).

7. *Philonotis fontana* (Hedw.) Brid. var. *fontana*

Common throughout the Interior Highlands; on moist soil and rock ledges along flowing water or standing surface water in glades.

20. TIMMIACEAE

1. *Timmia megapolitana* Hedw.

Plants in loose to dense tufts, green above, brown to yellow-green below, 3–5 cm tall; leaves crisped with inrolled margins when dry, spreading and margins plane when moist, 4–10 mm long and 1–1.5 mm wide, lanceolate to linear-lanceolate, apex gradually narrowing, base sheathing, concave to keeled; margins strongly toothed from just above the sheathing base to the apex with multicellular teeth; costa strong, papillose above, sub-percurrent to percurrent; leaf-cells rounded-hexagonal and collenchymatous above, thin-walled and linear in the sheathing base; autoicous; capsule erect to horizontal; seta red, 2–2.5 cm long; operculum rounded, apiculate; outer peristome teeth 16, yellowish, pellucid and slightly papillose below, longitudinally striate and often perforate above; inner peristome arising from a basal membrane about ½ length of outer teeth and ending in 64 cilia united into groups of 4; calyptra erect from seta behind the capsule.

Uncommon, Boston Mtns., Ozark Hills, Salem Plateau; on moist, shaded calcareous rocks and soil along banks of streams and gullies and on ledges.

When young sporophytes are present, the peculiar position of the calyptra is diagnostic for this taxon. Sterile plants may be recognized by the rather large size of the plants and the long leaves that have inrolled margins and are crispate when dry, and are strongly serrate with multicellular teeth and have thin-walled linear cells in the sheathing base.

21. ERPODIACEAE

1. *Venturiella sinensis* (Vent. *ex* Rabenh.) C. Müll.

Small plants in creeping, flattened mats with terete, erect branches, 2–4 mm long; leaves ovate, imbricate-appressed, widely spreading when moist, dark green with hyaline, denticulate tips; upper leaf-cells hexagonal, smooth, quadrate at margins, elongated and becoming linear in hyaline acumination; seta short; capsule pale yellow, oval-cylindric, 1.5 mm long, immersed to emergent.

Rare, south-western Boston Mtns.; on vertical, south facing sandstone. Known only from Cherokee Co., Oklahoma, on bluff along Terapin Creek near Hwy. 82, Sect. 24, T. 14 N., R. 22 W.

22. PTYCHOMITRIACEAE

Small to minute plants in yellowish to brownish or blackish green tufts; leaves crispate when dry, erect-spreading when moist, linear-subulate to linear-lanceolate, not plicate; costa percurrent to sub-percurrent; upper cells smooth, rounded to quadrate; capsule cylindrical to ovoid, exserted; peristome teeth 16, variously split; calyptra mitrate to campanulate-mitrate.

a. Leaves linear-subulate; seta arcuate when moist .... 1. *Campylostelium*
a. Leaves linear from a lanceolate base; seta straight when moist .... 2. *Ptychomitrium*

1. *Campylostelium* B.S.G.

1. *Campylostelium saxicolum* (Web. & Mohr) B.S.G.

Plants minute, in loose, yellow-green tufts; leaves subulate from a narrow, ovate base, crisped when dry, keeled; margins entire; median cells green and rectangular; basal cells thin-walled, elongate-rectangular, hyaline; capsule exserted on an arcuate seta, cylindrical, sulcate with age; operculum long subulate.

Rare, Boston Mtns.; on shaded, moist vertical sandstone.

2. *Ptychomitrium* Fürnr.

Plants in small, brownish to blackish green tufts; leaves crispate when dry, linear-lanceolate; margins entire to serrate in upper half; costa single, percurrent to sub-percurrent; seta short, 2–3 mm long, not arcuate; capsule ovoid; operculum subulate; calyptra mitrate to campanulate-mitrate.

a. Leaves entire or nearly so; plants growing on rocks .... b
a. Leaves serrate in upper half; plants growing on trees .... 3. *P. drummondii*
  b. Leaves 1.2–2.0 mm long; seta 2.0–2.5 mm long .... 1. *P. incurvum*
  b. Leaves 3.0–4.0 mm long; seta 4–5 mm long .... 2. *P. leibergii*

1. *Ptychomitrium incurvum* (Schwaegr.) Sull.

Common throughout the Interior Highlands; on exposed to shaded rocks.

This species characteristically grows in pockets of boulders. Colonies are seldom large, although they may be quite frequent.

2. *Ptychomitrium leibergii* Best

Rare, southern Salem Plateau; on limestone in cedar glade. A distinctive species known only from a cedar glade above the west bank of Norfork Lake, ca. ¼ mile west of Tecumseh, Sect. 16, T. 22, R. 12 W.

The leaves of this species are remarkably similar to the Asiatic species *P. sinense* Jaeg. However, the latter species has a longer seta and a more cylindrical capsule.

3. *Ptychomitrium drummondii* (Wils.) Sull.

Uncommon, Ouachita Mtns., Ozark Hills, St. Francois Mtns., Springfield Plateau; on trees.

This species may be more common than collection records indicate as sterile plants are likely to be mistaken for sterile species of *Orthotrichum.*

23. ORTHOTRICHACEAE

Dark, tufted plants, growing on trees and rocks; stems erect or creeping; leaves crowded, appressed or crispate when moist, keeled above, lanceolate; margins entire; costa strong; upper leaf-cells small, irregularly rounded, papillose; capsule immersed to exserted, erect and symmetric, often plicate; peristome double; calyptra mitrate, hairy or smooth.

a. Primary stems long and creeping .... 3. *Drummondia*
a. Plants erect, stems not creeping .... b
  b. Gemmae present in upper leaf axils .... 4. *Zygodon*
  b. Gemmae absent c
c. Capsule long exserted .... 2. *Ulota*
c. Capsule immersed to emergent .... 1. *Orthotrichum*

1. *Orthotrichum* Hedw.

Small, dark to brownish green tufted plants; stems erect, branched above; leaves lanceolate to ovate-lanceolate; costa strong; upper leaf-cells small, irregularly rounded, papillose on both surfaces; basal cells rectangular, rhomboidal to linear; capsules immersed to emergent, often ribbed and strangulate when dry; stomata scattered and immersed in our species; outer peristome teeth 16, often united in pairs and reflexed when dry; inner peristome when present of 8–16 narrow segments; calyptra usually campanulate, covering most of the urn, plicate, hairy.

A difficult genus where identification depends on the presence of old, mature capsules. The following key is based in part on the treatment of *Orthotricha straminea* by Crum and Anderson (1956) and on suggestions by Dr. Dale Vitt (personal communication).

a. Upper leaves with hyaline points .... 7. *O. diaphanum*
a. Upper leaves without hyaline points .... b
  b. Plants growing on rocks c
  b. Plants growing on trees .... d
c. Peristome papillose .... 2. *O. strangulatum*

c. Peristome striate .... 1. *O. cupulatum*
  d. Exostome teeth recurved .... e
  d. Exostome teeth reflexed .... f
e. Exothecial cells poorly differentiated .... 4. *O. pusillum*
e. Exothecial cells clearly differentiated .... 5. *O. pumilum*
  f. Capsule constricted below mouth; exothecial cells different in color from rest of capsule .... 6. *O. stellatum*
  f. Capsule not constricted below mouth .... 3. *O. ohioense*

1. *Orthotrichum cupulatum* Brid.

Rare, on rocks. Reported from McCurtain Co., Oklahoma, by Sharp (1930: 53).

2. *Orthotrichum strangulatum* P. Beauv.

Common, Boston Mtns., Prairie Plains, Salem and Springfield Plateaus; on open to shaded rocks.

3. *Orthotrichum ohioense* Sull. & Lesq. *ex* Aust.

Common, Boston and Ouachita Mtns., Salem and Springfield Plateaus; on tree trunks.

Plants often mixed with the next taxon. Capsules frequently strangulate with age.

4. *Orthotrichum pusillum* Mitt.

Common throughout the Interior Highlands; on tree trunks, rarely on sandstone.

5. *Orthotrichum pumilum* Sw.

Uncommon, Prairie Plains, Salem and Springfield Plateaus; on tree trunks.

6. *Orthotrichum stellatum* Brid.

Common, Boston and Ouachita Mtns., Salem and Springfield Plateaus; on tree trunks.

7. *Orthotrichum diaphanum* Brid.

Uncommon, Boston Mtns., Salem and Springfield Plateaus; on tree trunks and rarely acidic rocks.

2. *Ulota* Mohr *ex* Web.

1. *Ulota hutchinsiae* (Sm. *ex* Sowerby) Hammar

Ulota americana (P. Beauv.) Limpr.

Erect, dark green tufted plants; leaves closely imbricated when dry, concave-carinate, lanceolate to ovate-lanceolate, obtuse to obtusely acute; margins recurved; costa strong; upper leaf-cells thick-walled, circular to elliptic, papillose; capsule exserted, oblong-ovoid with long neck, 8-ribbed; peristome teeth 16, united in pairs; calyptra very hairy.

Uncommon, Boston and Ouachita Mtns.; on vertical shaded dolomite and sandstone. Locally abundant.

3. *Drummondia* Hook. *ex* Drumm.

1. *Drummondia prorepens* (Hedw.) Britt.

Primary stems creeping with numerous erect, short, dark green to blackish, densely foliate branches; leaves closely appressed when dry, oblong- to ovate-lanceolate, concave, carinate, acute to narrowly obtuse; margins plane or widely inrolled; upper leaf-cells small, rounded, thick-walled, smooth; capsule exserted, erect, on seta 2–3 mm long, symmetric, ovoid-globose; peristome teeth 16; calyptra conic, without hairs.

Common throughout the Interior Highlands; on trees, rarely on shaded acidic rocks.

4. *Zygodon* Hook. & Tayl.

1. *Zygodon apiculatus* Redfearn (1967).

Plants very small, 1–4 mm high, dark green, erect; leaves when dry erect, when moist widely spreading, crowded, keeled, oblong-lanceolate or oblong-ovate, acute, rather abruptly short apiculate, terminal cells of apiculus little elongated, yellowish-brown or concolorous; margins plane or slightly wavy; costa conspicuous, ending below apex and papillose near tip; upper leaf-cells green, hexagonal, thin-walled, pluripapillose on both surfaces; gemmae abundant in leaf axils, subcylindric to fusiform, composed of 3–4 (rarely 5) uniserrate cells.

Rare, Salem Plateau; on oak trees.

24. FONTINALACEAE

The following treatment follows the comprehensive monograph of this family by Winona Welch (1960).

Plants aquatic, filiform to robust, yellowish green, olive-green, brownish green, blackish green, golden brown, or reddish brown; stems flaccid to rigid, short to 90 cm long, often denuded near base, regularly to irregularly branched; leaves erect-spreading or spreading, distant to close, costate or ecostate, plane, concave to keeled, lanceolate, oblong-lanceolate, ovate-lanceolate, subovate, ovate, apices short to long acuminate, subacute, acute to obtuse; margins entire to serrate; median leaf-cells subrhombic, linear-rhomboidal, linear-rhombic to linear; alar cells not enlarged to enlarged, subquadrate, suboval or subhexagonal; auricles distinct or none; capsules usually erect, sessile or on a short seta, completely immersed to completely emergent; peristome double, teeth 16.

a. Leaves ecostate .... 1. *Fontinalis*
a. Leaves costate .... b
  b. Ends of foliated stems and branches conspicuously three-angled, not curved or uncinate; leaves not secund; capsule completely immersed; costa percurrent to ending below apex .... 2. *Brachelyma*
  b. End of foliated stems and branches not conspicuously three-angled, commonly slightly to distinctly curved, frequently uncinate; capsule emergent; leaves secund and falcate; costa long-excurrent .... 3. *Dichelyma*

1. *Fontinalis* Hedw.

Plants aquatic, floating or submerged; leaves tristichous, plane, subconcave, concave to canaliculate, subtubular, convolute-tubulose, subcarinate or carinate-conduplicate, ecostate, sublanceolate, lanceolate, oblong-lanceolate, ovate-lanceolate, ovate; margins plane to narrowly or broadly involute; apices short to long-acuminate, subacute, subobtuse or obtuse; median leaf-cells subrhomboidal, rhomboidal, linear-rhomboidal, linear; alar cells enlarged, subquadrate, subrectangular, or subhexagonal; capsule sessile or subsessile, immersed in perichaetial leaves or emergent.

a. Leaves usually plane .... b
a. Leaves usually concave .... d
  b. Leaves broadly ovate-lanceolate or oval-lanceolate; margins tapering from approximately middle into apex; apices short and broadly acuminate .... 7. *F. duriaei*
  b. Leaves generally narrowly ovate-lanceolate or lanceolate; margins tapering from basal ¼ or ½ into apex; apices long, acuminate c
c. Apices gradually narrowed, tips commonly acute and entire; auricles usually none .... 6. *F. hypnoides*
c. Apices often abruptly narrowed, tips commonly obtuse to truncate and serrulate; auricles very conspicuous .... 8. *F. flaccida*
  d. Margins usually involute .... e
  d. Margins not involute .... g
e. Margins near apex commonly narrowly involute .... 1. *F. novae-angliae*
e. Margins near apex commonly broadly involute .... f
  f. Apices long acuminate; apical cells rhombic, rhomboidal, quadrate, rectangular, or hexagonal .... 3. *F. biformis*
  f. Apices obtuse to truncate; apical cells linear or linear-rhomboidal .... 1b. *F. novae-angliae* var. *cymbifolia*
g. Apical cells rhomboidal, rhombic, quadrate, rectangular, or hexagonal .... 3. *F. biformis*
g. Apical cells linear or linear-rhomboidal .... h
  h. Stems flaccid; leaves usually subflaccid, lanceolate to ovate-lanceolate .. 2. *F. missourica*
  h. Stems rigid, leaves firm, narrowly lanceolate i
i. Leaves 0.75–1.5 mm wide .... 4. *F. disticha*
i. Leaves 0.35–0.5 mm wide .... 5. *F. filiformis*

1. *Fontinalis novae-angliae* Sull.

a. Margins commonly narrowly involute in apical portion .... b
a. Margins commonly broadly involute in apical portion .... 1b. *F. novae-angliae* var. *cymbifolia*
  b. Blades usually firm, ovate-lanceolate, 1–2 mm wide .... 1a. *F. novae-angliae* var. *novae-angliae*
  b. Blades usually flaccid, broadly ovate-lanceolate, 1.5–3.5 mm wide .... 1c. *F. novae-angliae* var. *latifolia*

1a. *Fontinalis novae-angliae* var. *novae-angliae*

Common throughout the Interior Highlands; on boulders, tree limbs and roots, in intermittently flowing streams, creeks and shallow gullies.

1b. *Fontinalis novae-angliae* var. *cymbifolia* (Aust.) Welch

Rare, reported from eastern Salem Plateau in Ste. Genevieve County, Missouri, by Gier (1955*a*).

1c. *Fontinalis novae-angliae* var. *latifolia* Card. *ex* Nichols

Rare, throughout the Interior Highlands (absent Ozark Hills); on sandstone in creeks and gullies.

2. *Fontinalis missourica* Card.

Common throughout the Interior Highlands; on noncalcareous rocks in streams and creeks.

3. *Fontinalis biformis* Sull.

Apparently rare, Salem Plateau; on limestone in creeks.

The collection (*Redfearn* 9889) from Taney County, Missouri, was distributed as *F. disticha.* The correct identification of this collection was made by Dr. Howard Crum.

4. *Fontinalis disticha* Hook. & Wils. *ex* Drumm.

Rare, Ouachita Mtns.; on rocks in intermittently flowing streams.

5. *Fontinalis filiformis* Sull. & Lesq. *ex* Aust.

Uncommon, Ouachita Mtns., Ozarks Hills, Salem Plateau; attached to stones and tree bases in swiftly flowing streams and creeks.

6. *Fontinalis hypnoides* C. J. Hartm.

Rare, Salem Plateau; attached to stone in spring branches.

7. *Fontinalis duriaei* Schimp.

Common, Salem and Springfield Plateaus; on tree bases and roots, and stones in swiftly flowing creeks, streams, and spring branches.

8. *Fontinalis flaccida* Ren. & Card.

Uncommon, Ouachita Mtns., eastern Salem Plateau; attached to rocks in gullies and in swampy areas.

2. *Brachelyma* Schimp. *ex* Card.

1. *Brachelyma subulatum* (P. Beauv.) Schimp. *ex* Card.

Plants slender, yellowish green, green to brown, youngest portion of stems conspicuously three-angled, regularly or irregularly pinnately branched; median cauline leaves 2–4 mm long and 0.5–1 mm wide, imbricate, firm, erect-spreading, carinate-conduplicate, subulate, oblong-lanceolate, sublanceolate, or lanceolate, apices obtuse or acute, keel straight to moderately curved, frequently abruptly curved near apex, leaf tips serrulate, occasionally entire; costa percurrent or ending a short distance below apex; median leaf-cells subrhombic, subrhomboidal or subhexagonal, 2–4 : 1; marginal cells linear with attenuate ends forming a border of 4–5 rows of cells; alar cells subquadrate or subrectangular; auricles slight or none, bases immersed in perichaetial leaves.

Rare, lowland regions of eastern Boston Mtns., southwestern Ouachita Mtns., eastern Salem Plateau; on bases of tupelo gum, cypress, and other lowland hardwoods, occasionally on sandstone boulders, edge of rivers, streams, and creeks.

3. *Dichelyma* Myr.

1. *Dichelyma capillaceum* (With.) Myr.

Plants relatively slender, yellowish green, green or brownish green with subrigid to rigid, irregularly divided stems; branches few to numerous; median cauline leaves close to distant, 4.5–7 mm long and 0.4–0.8 mm wide, firm, erect-ascending to occasionally erect-spreading, carinate-conduplicate, straight to moderately curved along keel or subfalcate to falcate, generally subsecund to secund, narrowly lanceolate, width gradually decreasing from base to apex; margins entire below to subserrulate above; apices subulate or acuminate; costa long excurrent, serrate or entire at end; median leaf-cells linear with attenuate ends, 10–20 : 1; alar cells indistinct, slightly enlarged, usually quadrate or rectangular; bases not decurrent; capsule at first immersed in perichaetial leaves, later laterally emergent.

Rare, Ouachita Mtns., Mississippi lowlands; attached to tree roots and sandstone in intermittently flowing creeks and gullies.

25. CLIMACIACEAE

1. *Climacium americanum* Brid.

Large plants with upright branches, 5–8 cm tall, usually tree-like, arising from an underground creeping stem; aerial branches usually tapering; leaves of main aerial stem large, 2.5–3.5 mm long and 1.5–2.0 mm wide, ovate, apex acuminate, base clasping; branch leaves of aerial stems smaller, 2.0–2.5 mm long and 1.0–1.5 mm wide, ovate-elliptic to oblong-lanceolate, auriculate, apex acute to obtuse, serrate; costa stout, reaching nearly the apex; median leaf-cells oblong-hexagonal, ends rounded to truncate, 2–7 : 1; alar cells short-rectangular to quadrate; paraphyllia filiform, numerous on branches and secondary stems; fruiting infrequently, capsule erect, cylindric, 5–6 : 1, symmetric, on long seta; peristome double, teeth 16, reddish-brown.

This species may be separated into two rather indistinct varieties based on the following key.

a. Median leaf cells of branch leaves 5–7 : 1	1a. *C. americanum* var. *americanum*
a. Median leaf cells of branch leaves 2–3 : 1	1a. *C. americanum* var. *kindbergii*

1a. *Climacium americanum* var. *americanum*

Common throughout the Interior Highlands; on moist shaded soil, particularly of ledges and bases of bluffs. Often very abundant.

The striking, tree-like growth habit of this plant is distinctive and not likely to be confused with any other species except perhaps *Thamnobryum alleghaniense* which is a smaller plant with a more coarsely serrate apex composed of distinctly rhomboidal cells.

1b. *Climacium americanum* var. *kindbergii* Ren. & Card.

Climacium kindbergii (Ren. & Card.) Grout

Less common than the preceding variety throughout the Interior Highlands; usually, but not necessarily, confined to substrates along shallow, rocky streams.

The distinction between these two varieties is poor and not consistent, and intergrading forms are encountered. One suspects that they may be no more than environmental forms. However, until such time as this is demonstrated, these varieties are retained.

26. HEDWIGIACEAE

A family of uncertain affinities represented in our area by a single taxon.

1. *Hedwigia ciliata* (Hedw.) P. Beauv.

Plants in loose, gray-green tufts, branching freely; leaves ecostate, broadly ovate-lanceolate, apex hyaline, serrate (occasionally absent); cells of leaf incrassate with branching papillae, rounded to oblong above, elongate below and becoming reddish along mid-line near base; capsule erect, immersed, symmetrical; peristome absent.

Very common throughout the Interior Highlands; on exposed to shaded rocks, rarely around the bases of trees. Often locally abundant.

Several forms have been described for this species. However, variability is erratic and often variation in ciliation of the perichaetial leaves or development of the hyaline point on stem leaves occurs within the same colony or clump. Anderson (1958: 291) is quite correct in not applying form names to such variations.

27. CRYPHAEACEAE

Plants small to moderately large, yellowish to dark green, in loose tufts or mats; secondary stems profusely to sparingly branched, densely foliate; leaves appressed-imbricate to julaceous when dry, more or less spreading when moist, concave, ovate, ovate-elliptical to ovate-lanceolate, apices acute or short acuminate; margins slightly recurved, entire or slightly serrulate near apex; costa single, strong or thin and reaching the middle of the leaf to double and almost lacking; median leaf-cells smooth or papillose, oblong-fusiform, rounded-oval to isodiametric, thick-walled; marginal cells rounded-quadrate, oval; capsule short-oblong to ovoid-cylindric, immersed to extending beyond perichaetial leaves; peristome double, teeth 16; calyptra more or less hairy.

a. Secondary stems profusely branched; if sparingly branched, seta long and capsule exserted beyond perichaetial leaves .... 2. *Forsstroemia*
a. Secondary stems sparingly branched; seta very short and capsule immersed in perichaetial leaves .... 1. *Cryphaea*

1. *Cryphaea* Mohr *ex* Web.[5]

1. *Cryphaea glomerata* B.S.G. *ex* Sull. var. *glomerata*

Plants small, slender, light to brownish green; secondary stems sparingly branched with leaves closely imbricated and julaceous when dry; leaves concave, ovate to ovate-elliptical, apices acute to short-acuminate; margins slightly reflexed below, entire or serrulate at apex; costa strong, reaching the middle of the leaf and projecting on the dorsal side; median leaf-cells papillose on dorsal surface, thick-walled, subcircular to oval; perichaetial leaves as long as or longer than capsule; seta very short; capsule short-oblong to ovoid; operculum conic; calyptra conical.

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[5] See "Note Added in Proof," p. 103.

Common in Boston and Ouachita Mtns., uncommon in Salem and Springfield Plateaus; on hardwoods and shrubs, particularly along creeks and streams. Occasionally very abundant.

2. *Forsstroemia* Lindb.

Plants moderately large to slender, yellowish to dark green, in dense to loose tufts; secondary branches profusely to sparingly branched, densely foliate; leaves plicate or smooth, appressed-imbricate when dry, spreading when moist, concave, ovate to ovate-lanceolate, apices acute to abruptly short-acuminate; margins entire or nearly so; costa reaching middle of leaf and strong, strongly protruding on dorsal side of leaf to thin, reaching middle of leaf or short and double to almost wanting; median leaf-cells smooth or slightly papillose, oblong-fusiform to rounded-oval; capsule ovoid to oblong, exserted or immersed in perichaetial leaves; calyptra hairy.

a. Secondary stems sparingly branched; leaves not plicate; costa strong and protruding on dorsal side .... 1. *F. ohioensis*

a. Secondary stems profusely branched; leaves plicate; costa thin, reaching middle of leaf to short and double .... 2. *F. trichomitria*

1. *Forsstroemia ohioensis* (Sull.) Lindb.

Leptodon ohioensis Sull.

Rare, known only from the vicinity of Gladden Creek in Shannon County, Missouri, on the Salem Plateau and along Roaring River Spring branch at Roaring River State Park, Barry County, Missouri, on the Springfield Plateau; on hardwoods and red cedar. May be more common as it is easily overlooked.

2. *Forsstroemia trichomitria* (Hedw.) Lindb.

Forsstroemia trichomitria var. *immersa* (Sull. & Lesq.) Lindb.
Leptodon trichomitrion (Hedw.) Mohr.

Common throughout the Interior Highlands; on hardwoods and red cedar and on shaded vertical rocks. Often very common.

The varieties established by earlier authors are not recognized in this study, a procedure in agreement with a recent treatment by Breen (1963: 108–109).

28. LEUCONDONTACEAE

1. *Leucodon* Schwaegr.

Plants green to dark green above and brownish below, with numerous moderately large, julaceous secondary stems that are suberect or pendent and curved outward from the substratum; secondary branches few; stem leaves crowded, appressed and imbricate when dry, spreading when moist, smooth or plicate when dry, straight to secund, concave, ecostate, ovate-elliptical to ovate or ovate-lanceolate, apices abruptly short-acuminate to gradually long-acuminate; margins plane or reflexed at base, entire to serrulate near apex; median leaf-cells smooth, rhomboidal, 3–5 : 1; apical cells similar, smooth or roughened-mammillose on back; cells near base and margin roundish quadrate; lower median cells linear-fusiform; capsule immergent or exserted, oblong-ovoid, erect and symmetrical; operculum conic-rostrate; peristome simple.

a. Leaves ovate-elliptical, abruptly short acuminate, scarcely plicate when dry; apical cells mammillose-roughened on back .... 2. *L. julaceus*
a. Leaves ovate to ovate-acuminate, not abruptly acuminate, plicate when dry; apical cells scarcely mammillose-roughened on back .... 1. *L. brachypus*

1. *Leucodon brachypus* Brid.

Rare, Boston and Ouachita Mtns., Salem plateau; on shaded rocks and trees.

2. *Leucodon julaceus* (Hedw.) Sull. fo. *julaceus*

Leucodontella julacea (Hedw.) Noguchi

Very common throughout the Interior Highlands; on shaded to open rocks, trees, stumps, and logs. Often very abundant.

Leucodon julaceus fo. *flagelliferous* Grout is occasionally encountered on tree trunks. It is distinguished from fo. *julaceus* by the presence of numerous long, slender, flagelliform branches bearing small lanceolate leaves.

29. NECKERACEAE

Plants small to robust, in loose mats, trailing, or dendroid, shining yellow-green, brownish green, to pale or dark green; branches complanate-foliate to terete; flagelliform or stoloniform branches often present; branch leaves symmetric to asymmetric, lingulate, spatulate, broadly ovate, to ovate, elliptic-oblong or oblong lanceolate, apices acute, abruptly acuminate to rounded-obtuse; margins plane, entire, slightly crenulate, serrate to coarsely and irregularly serrate above; costa present or absent; median leaf-cells smooth, quadrate to hexagonal or rhombic to linear-fusiform; capsule oblong-ovoid to oblong-cylindric, erect to cernuous.

a. Plants dendroid, branches terete-foliate; leaves strongly costate, coarsely and irregularly serrate above .... 4. *Thamnobryum*
a. Plants loosely tufted, at least some branches complanate-foliate; leaves ecostate or costa slender, not coarsely serrate above .... b
  b. Leaves with small lobes at adaxial base, ecostate .... 3. *Homaliadelphus*
  b. Leaves without small lobes at adaxial base, costate or ecostate c
c. Leaves with distinct but thin costa reaching middle of leaf .... 2. *Homalia*
c. Leaves ecostate .... 1. *Neckera*

1. *Neckera* Hedw.

1. *Neckera complanata* (Hedw.) Hüb.

Plants in green to pale green, glossy, loose mats; branches complanate-foliate; leaves lingulate or spatulate with short to elongated point, decurrent; margins plane, entire to denticulate above; median leaf-cells smooth, fusiform to linear-flexuose, 5–10 : 1; apical cells shorter; alar cells quadrate; vegetative propagation by means of elongated, stoloniform branches and numerous flagelliform branchlets.

Very rare, Boston Mtns.; on shaded vertical sandstone below overhanging ledges. Known only from Cleburne County, Arkansas, near Greer's Ferry Reservoir Dam.

2. *Homalia* (Brid.) B.S.G.

1. *Homalia trichomanoides* (Hedw.) B.S.G. fo. *gracilis* (James *ex* Peck) Crum

Homalia gracilis James *ex* Peck
Homalia jamesii var. *gracilis* (James *ex* Peck) Wagn.

Plants in green to dark green, glossy mats; shoots complanate-foliate, often ending in slender, terete-foliate branches; leaves asymmetrical, spatulate, shortly obtuse to rounded-obtuse; margins plane above, one side incurved at base, more or less entire; costa thin, reaching middle of leaf; median leaf-cells smooth, hexagonal; cells of upper part of leaf rhomboidal; basal cells quadrate to rectangular.

Rare, Boston Mtns., Salem Plateau; on shaded, vertical limestone, dolomite or sandstone, especially beneath overhanging ledges.

The nomenclature of this taxon follows the suggestion of Crum (1969: 243–244).

3. *Homaliadelphus* Dix. & P. de la Varde

1. *Homaliadelphus sharpii* (Williams) Sharp var. *sharpii*

Plants prostrate, in glossy, yellow- to brownish green patches; branches densely complanate-foliate; leaves broadly ovate, ecostate, with small lobes at adaxial base; margins entire or slightly crenulate; median leaf-cells smooth, short, rounded-hexagonal, thick-walled.

Very rare, known only from the Salem Plateau; on vertical, dry dolomite of bluffs along Jacks Fork River near Bay Creek, Shannon County, Missouri.

4. *Thamnobryum* Nieuwl.

1. *Thamnobryum alleghaniense* (C. Müll.) Nieuwl.

Plants robust, conspicuously dendroid, light to dark green; branches stout, terete-foliate; leaves loosely erect-spreading when dry, concave, ovate to elliptical-oblong or oblong-lanceolate, acute and coarsely irregularly serrate above; costa stout, toothed on back; median leaf-cells smooth, quadrate to hexagonal; basal cells longer, oblong to oblong-rectangular.

Uncommon, Boston Mtns., Ozark Hills, eastern Salem Plateau; on shaded, moist, vertical to flat sandstone exposures in narrow crevices and ledges, or on sandy soil along edges of creeks.

30. HOOKERIACEAE

1. *Hookeria acutifolia* Hook. & Grev.

Plants soft, glossy, whitish green to yellowish green, in soft mats; leaves closely imbricate and complanate, translucent, plane, ovate, ovate-lanceolate or oblong-ovate, ecostate, apices acute; margins entire; median leaf-cells oblong-hexagonal or oval-hexagonal, large and thin-walled; rhizoid-like filaments occasionally arise from leaf-cells.

Uncommon, Boston Mtns.; on sandstone and shale, usually of moist, shaded crevices or ledges.

31. THELIACEAE

Plants in slender, densely caespitose to closely interwoven, glaucous green to bluish green mats; stems creeping, more or less pinnately branching; branches short, erect to ascending, paraphyllia present or absent; leaves loosely imbricate to erect-open and distant to closely julaceous, round-ovate, concave, abruptly subulate or apiculate to slenderly acuminate, narrowed to insertion, slightly decurrent; margins plane, spinose-dentate, ciliate-serrulate to ciliate-laciniate below; costa short or lacking to reaching the middle of leaf; median leaf-cells with branched or unbranched papillae on dorsal surface, short, rounded-rhombic to fusiform; basal and apical cells longer and often smooth; seta 5–15 mm long; capsule erect and symmetric; operculum conic-rostrate; peristome double, teeth 16 and whitish.

a. Paraphyllia absent; leaves loosely imbricate to erect open; costa short or lacking .... 2. *Myurella*
a. Paraphyllia present; leaves closely julaceous; costa reaching middle of leaf, only occasionally short and double .... 1. *Thelia*

1. *Thelia* Sull.

Plants in slender, densely caespitose to closely interwoven, glaucous white mats; branches numerous, ascending, strongly julaceous; paraphyllia present, polymorphous, laciniate or ciliate; leaves very concave, abruptly subulate-acuminate, decurrent; margins plane, ciliate-laciniate, ciliate to laciniate below; costa single, reaching the middle of leaf to rarely short and double; median leaf-cells rhombic to fusiform with large forked or unforked papillae on the dorsal surface.

The following key to the species of this genus is adapted from one proposed by Crum (1966).

a. Dorsal papillae single .... 1. *T. hirtella*
a. Dorsal papillae forked, with two or more branches .... b
  b. Stems creeping, radiculose, once pinnately branched; leaves not particularly crowded; margins ciliate-papillose above, long-ciliate below; apex acute or obtuse, long-apiculate or piliform-apiculate .... 2. *T. asprella*
  b. Stems crowded and ascending, not or only slightly radiculose, irregularly branched; leaves crowded; margins not to somewhat ciliate-papillose, not long ciliate below; apex obtuse, short-apiculate .... 3. *T. lescurii*

1. *Thelia hirtella* (Hedw.) Sull.

Common throughout the Interior Highlands; on bark of hardwoods and red cedars, rarely on rocks.

Generally recognized in the field by its many erect-ascending branches that are all pointed to the same side of the stem.

2. *Thelia asprella* Sull.

Very common throughout the Interior Highlands; on bark of hardwoods, logs, rocks, and sterile soil, in dry open woods.

3. *Thelia lescurii* Sull. *in* Gray

Common throughout the Interior Highlands; on open dry soil, especially of oak-hickory woods, open cedar glades, and rocky barrens.

Gier and Kennedy (1955) consider this species to be an environmental form of *Thelia asprella.* However, Crum (1966) chooses for various reasons to retain *T. lescurii* as a valid species, which seems to be a reasonable decision.

2. *Myurella* B.S.G.

1. *Myurella sibirica* (C. Müll.) Reim. var. *sibirica*

Myurella careyana Sull.

Slender, small, glaucous green plants with stems erect to ascending; branches julaceous, numerous, often flagelliform at ends; paraphyllia absent; leaves very concave, loosely imbricate to erect-open and distant, broadly round-ovate to subcircular, abruptly apiculate to slenderly acuminate; margins spinose-dentate from base to apex; costa short or lacking; median leaf-cells rounded-rhombic, 1.5–2 : 1, pellucid, with a single large dorsal papilla over lumen.

Rare, Boston Mtns., Salem Plateau; in crevices of shaded, calcareous rocks.

32. FABRONIACEAE

Plants small and slender, in thin, glossy light to dark green mats or tufts; stems freely branching, densely foliate, imbricate when dry, erect-spreading when moist; leaves ovate to ovate-lanceolate, acuminate; margins entire or toothed; ecostate or costate; median leaf-cells thin-walled, oblong-rhombic to narrowly oblong-hexagonal, smooth or papillose on dorsal side; alar cells numerous to few, quadrate to short-rectangular; capsules exserted, erect, cylindric and symmetrical, often contracted strongly beneath mouth; operculum short-conic to long rostrate; peristome single or double.

a. Leaves ecostate; cells papillose on dorsal side; margins slightly denticulate .... 3. *Schwetschkeopsis*
a. Leaves costate; cells smooth; margins entire, toothed or laciniate-dentate .... b
  b. Leaves toothed or laciniate-dentate .... 1. *Fabronia*
  b. Leaves entire c
c. Peristome double; alar cells few, thin-walled, quadrate to rectangular, not extending 12–16 rows along margin .... 2. *Anacamptodon*
c. Peristome single; alar cells numerous, thick-walled, quadrate, forming large triangular area and extending along margin for 12–16 rows .... 4. *Clasmatodon*

1. *Fabronia* Raddi

Plants small and slender, in soft, thin, glossy, light green patches; stems irregularly branched, julaceous; leaves closely imbricate when dry, erect-spreading when moist, ovate-lanceolate, long acuminate; margins entire to dentate or dentate-laciniate; costate; median leaf-cells smooth, elongate-rhomboidal to elongate-hexagonal; alar cells quadrate, filling entire base and extending 12–20 rows up margin.

a. Leaves laciniate-dentate with teeth often of more than one cell .... 2. *F. gymnostoma*
a. Leaves entire to dentate with large projecting marginal cells .... b
  b. Leaves entire or nearly so .... 3. *F. ravenelii*
  b. Leaves irregularly serrate-dentate .... 1. *F. ciliaris*

1. *Fabronia ciliaris* (Brid.) Brid. var. *ciliaris*

Common throughout the Interior Highlands (except Ozark Hills); on trunks of hardwoods and red cedar and in crevices and vertical surface exposures of rocky bluffs.

Fabronia ciliaris var. *imperfecta* Sharp has been reported from the Salem and Springfield Plateaus by Gier (1955*a*: 34), who considers it to be a drought form of var. *ciliaris.*

2. *Fabronia gymnostoma* Sull. & Lesq. *ex* Sull.

Reported from the extreme western edge of the Arkansas Valley in Muskogee County, Oklahoma, by Little (1936).

3. *Fabronia ravenelii* Sull.

Rare, known only from Petit Jean Mountain, Conway County, Arkansas (Moore, 1965).

2. *Anacamptodon* Brid.

1. *Anacamptodon splachnoides* (F. Froel. *ex* Brid.) Brid.

Plants in dark, glossy, green mats; stems irregularly branching; leaves close, loosely spreading when dry, concave, ovate-lanceolate; margins entire; costa reaching middle of leaf; median leaf-cells smooth, rhombic-hexagonal, 2–3 : 1; upper leaf-cells longer, 4–6 : 1; basal cells thin-walled, rectangular to quadrate; capsule conspicuously contracted beneath mouth when dry.

Rare, known only from Ozark Hills, near Belle Smythe Springs, Pope County, Illinois, collected by R. Hatcher (*1239*); on tree trunk.

Anacamptodon splachnoides var. *tayloriae* is reported from Lafayette Co., Missouri, by Chamberlain (1919).

3. *Schwetschkeopsis* Broth.

1. *Schwetschkeopsis fabronia* (Schwaegr.) Broth.

Schwetschkeopsis denticulata (Sull.) Broth.

Plants in light olive- to yellow-green, glossy, crowded mats; stems slender, julaceous; leaves, concave, ovate-lanceolate, short-acuminate; margins slightly denticulate; ecostate; median leaf-cells oblong-oval to oblong-linear, 2–4 : 1, unipapillose on dorsal surface; basal cells quadrate to irregularly rectangular.

Common to uncommon throughout the Interior Highlands; on smooth-barked hardwood tree trunks and on shaded, moist dolomite, sandstone, and novaculite.

4. *Clasmatodon* Hook. & Wils. *ex* Wils.

1. *Clasmatodon parvulus* (Hampe) Hook. & Wils. *ex* Sull. var. *parvulus*

Plants in thin, light to dark green mats; branches short, irregularly divided, more or less julaceous; leaves crowded, concave, ovate to broadly ovate-lanceolate, slenderly acuminate to abruptly short-acuminate, acute or obtuse in branch leaves; margins plane and entire; costate; median leaf-cells smooth, rhomboidal, 1–3 : 1; alar cells numerous, quadrate, forming across the base to near costa and extending 12–16 rows along margin; seta short, erect; capsule exserted cylindric and symmetric; operculum with a curved beak.

Common throughout the Interior Highlands; on trunks of hardwood trees and on shaded vertical surfaces of rocky bluffs.

Clasmatodon parvulus var. *rupestris* Sull. & Lesq. *ex* Lesq. & James occurs scattered throughout the Boston Mtns. and the Salem and Springfield Plateaus, on shaded, vertical surfaces of rocky bluffs. It may be distinguished from var. *parvulus* by its more densely tufted habit and broadly ovate and obtuse to obtusely acute branch leaves.

33. LESKEACEAE

Plants slender to moderate in size, forming green to light or dark green mats or loose spreading tufts; stems prostrate, subpinnately to pinnately divided; branches erect and ascending; paraphyllia few or none; leaves imbricate when dry, concave to subconcave, ovate to ovate-lanceolate, not to slightly decurrent, apices rounded, obtuse to narrowly acuminate; margins plane to one or both margins revolute, usually entire; costa present, usually ending at middle of leaf or beyond; median leaf-cells papillose, quadrate-hexagonal to oval or elliptic-rhomboid; capsule oval, oblong-cylindric, erect to curved and inclined; peristome double, teeth 16.

a. Apices of leaves hyaline .... 1. *Lindbergia*
a. Apices of leaves green .... 2. *Leskea*

1. *Lindbergia* Kindb.

1. *Lindbergia brachyptera* (Mitt.) Kindb.

Plants procumbent, irregularly branched, in loose tufts; leaves imbricate when dry, broadly deltoid-ovate, acuminate, concave; margins plane, entire or nearly so; costa extending to middle of leaf or beyond; median leaf-cells distinctly papillose, rounded to short-oval or rhombic-hexagonal, longer and hyaline at apex; capsule ovoid-cylindric, erect and symmetric; operculum short-conic.

Common, Boston Mtns., Salem and Springfield Plateaus, unaccountably rare in the Ouachita Mtns., and absent in the Ozark Hills; on bark of hardwoods, never in great abundance.

2. *Leskea* Hedw.

Small to medium-sized plants growing in yellow- to dark green or reddish brown mats or tufts; stems prostrate, pinnately to subpinnately or sparingly branched; branches simple, erect or ascending; paraphyllia few; leaves loosely appressed to subjulaceous when dry, ovate to ovate-lanceolate, apices acute, acuminate, or obtuse; costate; margins plane or revolute, entire to serrulate; median leaf-cells papillose, isodiametric, quadrate-hexagonal; capsule oval to subcylindric, erect or curved; operculum mammillate to long conic.

a. Leaves small, averaging less than 0.6 mm long; median leaf-cells 5–7 μ wide .... 2. *L. australis*
a. Leaves larger, averaging more than 0.7 mm long; median leaf-cells 7–10 μ wide .... b
 b. Capsules curved .... 1. *L. arenicola*
 b. Capsules straight c
c. Stem leaves asymmetric, not plicate, margins not revolute, apices rounded-obtuse to sub-acute .... 4. *L. obscura*
c. Stem leaves symmetric, biplicate, one or both margins usually recurved, apices gradually acute, obtuse, or blunt-pointed .... d
 d. Stem leaves averaging more than twice as long as wide .... 5. *L. polycarpa*
 d. Stem leaves averaging less than twice as long as wide .... 3. *L. gracilescens*

1. *Leskea arenicola* Best

Rare, known only from the western edge of Springfield Plateau near Lamar, Barton County, Missouri; on trunks and logs of hardwoods.

2. *Leskea australis* Sharp

Rare, eastern Ouachita Mtns., Mississippi lowlands, Salem Plateau; on bases of hardwoods and cypress.

3. *Leskea gracilescens* Hedw.

Very common throughout the Interior Highlands; on trunks and bases of hardwoods and shaded rocks, especially along streams.

4. *Leskea obscura* Hedw.

Common throughout the Interior Highlands; on trunks and bases of hardwoods and shaded rocks, especially along streams.

5. *Leskea polycarpa* Hedw. var. *polycarpa*

Uncommon, reported from Ozark Hills (Hauge, 1934), Salem, and Springfield Plateaus (Gier, 1955*a*: 36).

Leskea polycarpa var. *paludosa* (Hedw.) Schimp. has been reported from the Ouachita Mtns., in McCurtain County, Oklahoma, by Sharp (1930). It may be distinguished from var. *polycarpa* by its more robust form and diffuse branches.

34. THUIDIACEAE

Plants minute to robust, in bright to dark green mats; main stems creeping; branches simple, pinnate, bipinnate to irregular, ascending; paraphyllia present or absent; leaves erect-spreading, plane or plicate, ovate, ovate-lanceolate to lingulate, apices acuminate to rounded-obtuse; margins plane or recurved, denticulate, serrate, rarely entire; median leaf-cells usually papillose, mostly short and rounded, but occasionally oblong to linear-rhomboidal; branch leaves often different from larger stem leaves; capsule erect and symmetric to inclined and asymmetric; peristome double, teeth 16.

- a. Paraphyllia lacking .... b
- a. Paraphyllia present c
  - b. Leaves strongly and irregularly serrate above .... 3. *Herpetineuron*
  - b. Leaves not strongly and irregularly serrate above .... e
- c. Median leaf-cells linear-rhomboidal, 8–15 : 1 .... 6. *Helodium*
- c. Median leaf-cells rounded quadrate to short-rectangular .... d
  - d. Apical cells of branch leaves unipapillate .... 4. *Haplocladium*
  - d. Apical cells of branch leaves pluripapillate .... 5. *Thuidium*
- e. Plants slender; leaf tips green, brittle with many older tips broken off .. 1. *Haplohymenium*
- e. Plants robust; if slender, leaf tips hyaline .... 2. *Anomodon*

1. *Haplohymenium* Dozy & Molk.

1. *Haplohymenium triste* (Ces. *ex* De Not.) Kindb.

Anomodon tristis (Ces.) Sull. & Lesq.

Plants in slender, dull green, interwoven mats; stems prostrate, irregularly to subpinnately branching; ultimate branches erect to ascending; leaves appressed when dry, brittle, with tips of older leaves often broken off, ovate-lanceolate, broadly acute to slender at apex; margins crenulate, apices rounded to apiculate; costa ending near middle of leaf; median leaf-cells rounded to polygonal, more or less isodiametric, turgid, pluripapillate on both surfaces; basal cells near costa smooth and elongated.

Very common throughout the Interior Highlands; on hardwoods and cedars and shaded vertical rock surfaces.

2. *Anomodon* Hook. & Tayl.

Plants in yellow to dark green, dense mats or cushions; primary stems creeping, nearly leafless, secondary stems numerous, erect or ascending, sometimes flagelliform; paraphyllia absent; leaves brittle, close, acuminate or lingulate from ovate base; margins plane and entire; costa strong and usually ending below apex; median leaf-cells small, rounded-hexagonal, densely papillose on both surfaces; basal cells smooth and elongated; capsules erect and symmetric; operculum conic or rostrate.

- a. Plants slender; leaves acuminate, ending in hair point .... 3. *A. rostratus*
- a. Plants coarse; leaves lingulate, not ending in hair point .... b
  - b. Secondary stems much branched, many attenuate to flagelliform branches evident; leaves often apiculate or toothed at apex .... 1. *A. attenuatus*
  - b. Secondary stems sparingly branched, attenuate or flagelliform branches absent c
- c. Upper portion of leaves lingulate-lanceolate, conspicuously tapering to the apex, somewhat contorted and crisped when dry, often secund; usually growing on rocks .... 5. *A. viticulosus*
- c. Upper portion of leaves lingulate, not conspicuously tapering, not secund; usually growing on trees, stumps, or logs .... d
  - d. Leaves not decurrent, often apiculate, fimbriate-papillose auricles present, somewhat crisped when dry .... 4. *A. rugelii*
  - d. Leaves decurrent, not apiculate, without auricles, scarcely contorted when dry .... 2. *A. minor*

1. *Anomodon attenuatus* (Hedw.) Hüb.

Very common throughout the Interior Highands; on hardwood tree trunk and bases, stumps, and logs, on shaded rocks and soil.

2. *Anomodon minor* (Hedw.) Fürnr.

Very common throughout the Interior Highlands; on hardwood tree trunks and bases, stumps, and logs, on shaded rocks and soil.

3. *Anomodon rostratus* (Hedw.) Schimp.

Very common throughout the Interior Highlands; on hardwood and cedar tree trunks and bases, stumps, and logs, on shaded, moist rocks. Often extremely abundant with mats covering large areas.

4. *Anomodon rugelii* (C. Müll.) Keissl.

Reported from the Ozark Hills by Hauge (1934).

5. *Anomodon viticulosus* (Hedw.) Hook. & Tayl.

Uncommon, Boston Mtns., Salem and Springfield Plateaus; on shaded vertical limestone and dolomite exposures.

3. *Herpetineuron* (C. Müll.) Card.

1. *Herpetineuron toccoae* (Sull. & Lesq. *ex* Sull.) Card.

Plants loosely caespitose, moderately robust and dark green; secondary stems simple, little divided, densely foliate, often subcircinate; paraphyllia absent; leaves irregularly imbricate when dry, ovate-lanceolate, concave, plicate below, plane above; margins reflexed at base, plane and strongly and irregularly serrate above; costa strong, ending in or near apex; median leaf-cells very small, uniform, rounded-quadrate, thick-walled, smooth; capsule erect and symmetric.

Uncommon, Boston and Ouachita Mtns., Ozark Hills; on moist, shaded, vertical sandstone and novaculite, occasionally on logs.

4. *Haplocladium* (C. Müll.) C. Müll.

Plants in loose yellowish to dark green mats, regularly to pinnately divided; paraphyllia numerous, multiform; stem leaves broadly rounded-ovate to ovate-lanceolate, gradually to abruptly acuminate, rounded at base and narrowed to insertion, scarcely plicate to biplicate; margins plane or revolute, entire or serrate to erose-dentate; costa almost percurrent; branch leaves smaller, less slenderly acuminate; median leaf-cells quadrate-oblong to oval-rhombic or hexagonal, unipapillate; apical cell of branch leaves unipapillate; capsule oblong, curved and inclined to drooping.

a. Stem leaves roundish-ovate, scarcely plicate, abruptly acuminate to a broad, oblong point; margins erose-serrate .... 2. *H. virginianum*

a. Stem leaves gradually long-acuminate, biplicate; margins crenulate-serrate or entire .... 1. *H. microphyllum*

1. *Haplocladium microphyllum* (Hedw.) Broth.

Uncommon throughout the Interior Highlands; on shaded, moist, tree bases, rocks, and soil.

2. *Haplocladium virginianum* (Brid.) Broth.

Very common throughout the Interior Highlands; on shaded rocky soil, tree bases, and rock ledges, particularly of open, upland hardwood forests.

5. *Thuidium* B.S.G.

Minute to robust plants in yellowish, greenish or brownish mats; stems creeping, ascending or erect, pinnately branched, often regularly and in one plane; branches simple, pinnate or bipinnate; paraphyllia numerous, simple or branched; stem leaves ovate-triangular to oblong-lanceolate, acuminate, cordate, strongly costate, papillose on one or both surfaces; branch leaves smaller, ovate to ovate-lanceolate; apical cell pluripapillate; capsule oblong-cylindric, unsymmetric, suberect to pendulous; operculum short-conic to long-rostrate.

a. Plants small to minute; paraphyllia few, small, mostly 2–6 cells long .... b
a. Plants large; paraphyllia many, more or less branched c
  b. Branches papillose .... 4. *T. pygmaeum*
  b. Branches smooth .... 3. *T. minutulum*
c. Stem leaves spreading-recurved, abruptly narrowed to a long acumen; costa ending below apex but continued by a series of long, narrow cells that fill the apex; papillae of paraphyllia located close to forward septum; perichaetial leaves not ciliate .... 2. *T. recognitum*
c. Stem leaves erect-spreading, gradually acuminate; costa ending below apex, cells of acumen never long, similar to those of rest of leaf; papillae of paraphyllia borne medianly; perichaetial leaves ciliate .... 1. *T. delicatulum* var. *delicatulum*

1. *Thuidium delicatulum* (Hedw.) B.S.G. var. *delicatulum*

Common throughout the Interior Highlands; on moist, shaded soil, humus, and rock ledges. Often very abundant.

Thuidium delicatulum var. *radicans* Crum, Steere & Anderson has been reported from the Salem Plateau by Gier (1955*a*: 38). It may be distinguished from var. *delicatulum* by the long, slender and hyaline apex of its stem leaves.

2. *Thuidium recognitum* (Hedw.) Lindb.

Very common throughout the Interior Highlands; on dry, open, rock, calcareous soil, particularly of upland hardwood and hardwood-pine forests. Often very abundant.

3. *Thuidium minutulum* (Hedw.) B.S.G.

Uncommon throughout the Interior Highlands; on shaded logs and tree bases, occasionally on stones.

4. *Thuidium pygmaeum* B.S.G.

Common throughout the Interior Highlands; on moist, shaded rocks along creeks and gullies.

6. *Helodium* (Sull.) Warnst.

1. *Helodium paludosum* (Sull.) Aust.

Plants in green to yellowish green deep, soft, tufts, branching irregularly pinnate; paraphyllia dense, filamentous and branched; stem leaves erect spreading when moist, plicate-striate, oblong- to ovate-lanceolate, narrowly to scarcely decurrent at base; margins revolute below, sinuate-serrulate above; costa nearly percurrent; median leaf-cells long, 8–15 : 1, oblong to linear-rhomboidal, smooth or only slightly papillose at distal ends of dorsal surface; branch leaves narrower and smaller, less slenderly acuminate; capsule oblong-cylindric, curved, inclined to horizontal.

Rare, known only from Ozark Hills in Pope County, Illinois, at Azotus Spring, on open wet soil of a seep spring.

35. AMBLYSTEGIACEAE

Plants creeping and irregularly to pinnately branching; leaves straight to secund, imbricate, erect-spreading to squarrose-spreading, oblong-ovate, ovate-lanceolate to triangular, cordate, acuminate to rounded or obtuse; margins entire to serrulate, plane or recurved, sometimes composed of elongated cells; costa single, short to percurrent or excurrent, sometimes short and double or absent; median leaf-cells smooth, hexagonal, rhomboidal to narrowly linear; alar cells often enlarged and inflated, colored or hyaline, often decurrent; seta usually tall, reddish or red, smooth; capsule usually curved, unsymmetric, cernuous, often contracted below mouth when dry; peristome double.

a. Paraphyllia present on stem .... 1. *Cratoneuron*
a. Paraphyllia absent .... b
  b. Leaves with a distinct border of elongated, thick-walled cells .... 3. *Sciaromium*
  b. Leaves without a distinct border of elongated, thick-walled cells c
c. Leaves falcate-secund; alar cells large, inflated and markedly decurrent .. 6. *Drepanocladus*
c. Leaves not falcate-secund; if falcate secund, alar cells not large, inflated, and decurrent .... d
  d. Plants small, very slender; leaves averaging less than 0.6 mm long .... 5. *Platydictya*
  d. Plants not small and very slender; leaves averaging more than 0.6 mm long; if smaller, widely spreading to squarrose .... e
e. Alar cells in distinct, more or less well defined group; leaves widely spreading, recurved .... 2. *Campylium*
e. Alar cells not in a distinct group; leaves erect spreading to widely spreading, not recurved .... 4. *Amblystegium*

1. *Cratoneuron* (Sull.) Spruce

1. *Cratoneuron filicinum* (Hedw.) Spruce var. *filicinum*

Plants green, yellowish green, or golden yellow, mostly irregularly to pinnately branched; branches slender, short, stiff, usually hooked at apex; paraphyllia oval to lanceolate, divided, numerous to few on stem; stem leaves erect-spreading to slightly falcate, oval to triangular, apices acuminate, bases decurrent, cordate; margins serrulate to denticulate; costa single, percurrent or excurrent; median leaf-cells smooth, elliptic-hexagonal, rectangular to oblong-linear; alar cells hyaline or colored, abruptly inflated, rectangular, extending from margin to costa or nearly so; capsule cylindrical, curved; peristome double.

Uncommon, Boston Mtns., Salem Plateau; in wet, usually calcareous habitats.

This species is highly variable and small slender forms may be confused with *Amblystegium varium*, particularly if paraphyllia are few; however, inflated alar cells are lacking in *A. varium.* Some confusion with *Drepanocladus aduncus* is also possible; however, that species always lacks paraphyllia, its leaves are falcate-secund, and its inflated alar cells do not usually reach the costa.

2. *Campylium* (Sull.) Mitt.

Plants slender or robust, in yellowish to golden brownish mats, branching irregularly from prostrate stem; leaves squarrose, ovate, ovate-lanceolate to triangular-cordate, apices long to abruptly acuminate, bases often decurrent; margins entire to serrulate; costa single and reaching middle of leaf, or short and double, or absent; median leaf-cells smooth, oblong-linear, prosenchymatous, 3–10 : 1; alar cells in distinct group, quadrate, subrectangular, often thick-walled and slightly inflated; seta long; capsule oblong-cylindric, curved, contracted beneath mouth when dry and empty; peristome double, teeth 16.

a. Leaves 1–1.5 mm long; costa single, reaching middle of leaf or beyond ... 2. *C. chrysophyllum*
a. Leaves 0.8 mm or less long; costa short and double, or absent ... 1. *C. hispidulum*

1. *Campylium hispidulum* (Brid.) Mitt.

Two varieties of this species are recognized, and although their differences are not striking, they can be separated on the basis of the following key (for extensive discussion see: Andrews, 1957: 129–133).

a. Leaves squarrose, abruptly acuminate; alar cells well differentiated ... 1a. *C. hispidulum* var. *hispidulum*
a. Leaves erect-spreading, slenderly acuminate; alar cells poorly differentiated ... 1b. *C. hispidulum* var. *sommerfeltii*

1a. *Campylium hispidulum* var. *hispidulum*

Very common throughout the Interior Highlands; particularly around bases of hardwood trees, on decaying wood and on calcareous soil, occasionally on rocks.

1b. *Campylium hispidulum* var. *sommerfeltii* (Myr.) Lindb.

Reported from the western Salem Plateau and the Springfield Plateau by Gier (1955*a*: 33).

2. *Campylium chrysophyllum* (Brid.) J. Lange

Two varieties are recognized in the Interior Highlands and may be separated as follows:

a. Plants very robust; leaves more or less falcate, apex usually serrate ... 2b. *C. chrysophyllum* var. *brevifolium*
a. Plants large; leaves not falcate, apex entire ... 2a. *C. chrysophyllum* var. *chrysophyllum*

2a. *Campylium chrysophyllum* var. *chrysophyllum*

Very common throughout the Interior Highlands; on open to shaded soil, rocks, tree bases. Often very abundant.

2b. *Campylium chrysophyllum* var. *brevifolium* (Ren. & Card.) Grout

Uncommon, Salem and Springfield Plateaus; on moist, shaded soil and rocks.

3. *Sciaromium* Mitt.

1. *Sciaromium lescurii* (Sull.) Broth.

Platylomella lescurii (Sull.) Andrews

Plants in loose, dark green mats, branching irregularly; stem leaves loosely spreading, broadly cordate-ovate to oblong-ovate, abruptly acuminate to subobtuse, serrulate at apex, bordered by rows of thick-walled, elongated cells; costa thick, reaching apex where confluent with border; median leaf-cells, smooth, oblong-hexagonal to short-rhomboidal, 1–3 : 1; basal cells and alar cells more or less rectangular; branch leaves narrower, ovate-lanceolate to lingulate, often obtuse, border of thick-walled cells indistinct; capsule cylindrical, curved and cernuous.

Common, Boston and Ouachita Mtns., uncommon Ozark Hills, Salem and Springfield Plateaus; on acidic rocks in and along edge of gullies, creeks, and streams.

As has been suggested earlier (Grout, 1931: 75), this species resembles the *Hygroamblystegium* complex of the genus *Amblystegium*. It should probably be assigned to that genus.

4. *Amblystegium* B.S.G.

The treatment of this very complicated genus follows the suggestion by Conard (1959) in that it includes the genera *Leptodictyum* and *Hygroamblystegium*, a procedure also followed by Nyholm (1965: 482–493). As noted by Conard, this is a return to the broad concept of the genus *Amblystegium* used by the authors of *Bryologia Europaea*, 1853. Considering the continuum of variation from *Leptodictyum* to *Hygroamblystegium* to *Amblystegium* (*sensu stricto*), this procedure seems entirely reasonable.

Plants slender to robust, light to dark green, mostly irregularly divided; leaves erect-spreading to widely spreading, sometimes almost complanate, triangular-ovate, ovate-lanceolate to lanceolate, apices short acuminate to long acuminate, tips acute to occasionally obtuse, bases narrowed, rounded or almost cordate to insertion; margins plane, entire to serrulate; costa extending to middle of leaf, percurrent or excurrent; median leaf-cells smooth, elongate-hexagonal to linear, 2–16 : 1; alar cells usually indistinctly limited, short-rectangular to rectangular, sometimes a few inflated; seta long, smooth, often twisted, reddish; capsule subcylindric, unsymmetric to arcuate, inclined to horizontal, contracted below mouth when dry; operculum conic, obtuse to apiculate; peristome double, teeth 16.

There is probably no other genus of mosses in the Interior Highlands where the characters separating species are so unclear. This may be due to environmental effects on growth, it may be genetical, or it may be a combination of both. The latter seems highly probable. The following key is an attempt to segregate the numerous perplexing forms into groups that correspond to currently recognized taxa. It may well be that many of the varieties should be species, although it is also possible that they are only forms. It is also a distinct possibility that some species are only varieties or even just forms. A careful monograph of this genus is long overdue, and until such time as this can be done, the parameters of the taxa included in this key should be considered tentative.

a. Median leaf-cells averaging 8–16 : 1 .... 1. *A. riparium*
a. Median leaf-cells averaging 3–8 : 1 .... b
  b. Costa of stem leaves subpercurrent, percurrent, or excurrent c
  b. Costa of stem leaves ending near middle of leaf .... g
c. Plants not aquatic; leaves broadly ovate-lanceolate, abruptly narrowed into a long, narrow acumen .... d
c. Plants aquatic; leaves cordate-ovate, triangular-ovate, oblong-lanceolate, oblong-ovate, not abruptly narrowed into long, narrow acumen .... e
  d. Leaves widely spreading; costa extending $6/7$ length of leaf .... 3. *A. trichopodium*
  d. Leaves erect-spreading; costa percurrent or nearly so .... 8. *A. varium*
e. Leaves narrowed to base .... 9. *A. tenax*
e. Leaves rounded to base .... f
  f. Many leaves with very strong, excurrent costa .... 11. *A. noterophilum*
  f. Costa percurrent in most leaves .... 10. *A. fluviatile*
g. Plants robust, somewhat complanate, distinctly aquatic, usually growing in swiftly flowing water .... 5. *A. laxirete*
g. Plants smaller, growing on moist substrates, but not aquatic .... h
  h. Leaves erect-spreading; basal cells quadrate to tranversely elongate i
  h. Leaves widely spreading; basal cells oblong to rectangular .... j
i. Leaves short acuminate .... 2. *A. brevipes*
i. Leaves long acuminate .... 6. *A. serpens*
  j. Leaf margins almost entire .... 4. *A. kochii*
  j. Leaf margins serrulate .... 7. *A. juratzkanum*

1. *Amblystegium riparium* (Hedw.) B.S.G.

Leptodictyum riparium (Hedw.) Warnst.

A number of poorly defined forms of this species are recognized and may be separated by the following characters suggested by Conard (1959: 102–103).

a. Apex of leaf acute, ending in mostly 2 cells .... 1e. *A. riparium* fo. *obtusum*
a. Apex acuminate to slenderly acuminate, ending mostly in 1 cell .... b
  b. Plants of wet habitats, but not floating or submerged .... 1a. *A. riparium* fo. *riparium*
  b. Plants floating or submerged c
c. Plants usually floating; leaves 3.5–5 mm long, acumination very long filiform .... d
c. Plants submerged-floating; apices long and filiform .... 1c. *A. riparium* fo. *fluitans*
  d. Leaves crowded, imbricate .... 1b. *A. riparium* fo. *elongatum*
  d. Leaves distant .... 1d. *A. riparium* fo. *longifolium*

1a. *Amblystegium riparium* fo. *riparium*

Common throughout the Interior Highlands; on wet soil, decaying wood, and rocks.

1b. *Amblystegium riparium* fo. *elongatum* (B.S.G.) Moenk.

Leptodictyum riparium var. *elongatum* (B.S.G.) Warnst.

Uncommon, Salem and Springfield Plateaus; on rock in creeks and streams.

1c. *Amblystegium riparium* fo. *fluitans* (Lesq. & James) Grout

Reported from the northern Salem Plateau (Hickory Co., Missouri) by Gier (1955*a*: 36).

1d. *Amblystegium riparium* fo. *longifolium* (Schultz) Warnst.

Rare, Boston and Ouachita Mtns., eastern Salem Plateau; on rocks in streams and creeks.

1e. *Amblystegium riparium* fo. *obtusum* (Grout) Grout

Common, Boston Mtns., Salem and Springfield Plateaus; on rocks (mostly calcareous) in swiftly flowing water.

2. *Amblystegium brevipes* Card. & Thér.

Leptodictyum brevipes (Card. & Thér. *ex* Holz.) Broth.

Rare, eastern Salem Plateaus; on moist shaded soil.

3. *Amblystegium trichopodium* (Schultz) Hartm.

Leptodictyum trichopodium (Schultz) Warnst.

Uncommon, Salem and Springfield Plateaus; on moist rocks and soil.

4. *Amblystegium kochii* B.S.G.

Leptodictyum trichopodium var. *kochii* Lindb.

Common, Salem and Springfield Plateaus; on moist rocks, decaying wood, and soil.

Large forms of *Amblystegium juratzkanum* may easily be confused with this species. Some forms can be confused with *A. varium* or *A. tenax*. Certainly the relation between these taxa is perplexing and in crying need of biosystematic study.

5. *Amblystegium laxirete* Card. & Thér.

Uncommon, Boston and Ouachita Mtns., Salem and Springfield Plateaus; usually on calcareous rocks in swiftly flowing water.

6. *Amblystegium serpens* (Hedw.) B.S.G.

Common throughout the Interior Highlands; on moist shaded rocks, woods, and soil. Occasionally on the bases of trees.

7. *Amblystegium juratzkanum* Schimp.

Uncommon, Boston Mtns., Ozark Hills, Prairies, Plains, Salem and Springfield Plateaus; on shaded moist rocks, rotten wood, and soil.

Nyholm (1965: 484–485) treats this species as a variety of *Amblystegium serpens*.

8. *Amblystegium varium* (Hedw.) Lindb.

Two varieties may be recognized in the Interior Highlands and may be separated as follows:

a. Leaves concave, round-ovate; median leaf-cells 2 : 1 .... 8b. *A. varium* var. *ovatum*
a. Leaves slightly concave, ovate-lanceolate; median leaf-cells 2–5 : 1 ....
.... 8a. *A. varium* var. *varium*

8a. *Amblystegium varium* var. *varium*

Common throughout the Interior Highlands; on moist, shaded soil, rocks, logs, and tree bases.

May be confused with *Amblystegium kochii* or *A. tenax*, see note under first species.

8b. *Amblystegium varium* var. *ovatum* (Grout) Grout

Rare, Salem and Springfield Plateaus; on tree bases.

9. *Amblystegium tenax* (Hedw.) C. Jens.

Amblystegium irriguum B.S.G.
Hygroamblystegium irriguum (Wils.) Loeske
Hygroamblystegium tenax (Hedw.) Jenn.

Two varieties of this species are recognized in the Interior Highlands and may be separated as follows:

a. Costa very thick, wide, percurrent to long often ending diffusely in apex, excurrent
.... 9b. *A. tenax* var. *spinifolium*
a. Costa thick, extending ¾ length of blade to percurrent, not ending diffusely in apex
.... 9a. *A. tenax* var. *tenax*

9a. *Amblystegium tenax* var. *tenax*

Very common throughout the Interior Highlands; on rocks, decaying wood, and tree bases in creeks, streams and seepage areas.

9b. *Amblystegium tenax* var. *spinifolium* (Schimp.) Jenn.

Common, Boston Mtns., Salem and Springfield Plateaus; on rocks in swiftly flowing streams, creeks, and spring branches, rarely where seepage occurs.

10. *Amblystegium fluviatile* (Hedw.) B.S.G.

A highly variable taxon in which three varieties and one form have been recognized in the Interior Highlands. These may be separated as follows:

a. Leaves broadly cordate-ovate; costa narrowing from base to apex ....
.... 10b. *A. fluviatile* var. *orthocladon*
a. Leaves ovate, ovate-lanceolate; costa not narrowing noticeably from base to apex .... b
  b. Leaves broadly ovate, apices broadly obtuse .... 10c. *A. fluviatile* var. *ovatum*
  b. Leaves oblong-lanceolate to oblong-ovate, apices subobtuse c
c. Leaves oblong-lanceolate; costa ending below apex ....
.... 10a(1). *A. fluviatile* var. *fluviatile* fo. *fluviatile*
c. Leaves ovate-lanceolate, costa ending diffusely in apex ....
.... 10a(2). *A. fluviatile* var. *fluviatile* fo. *brevifolium*

10a(1). *Amblystegium fluviatile* var. *fluviatile* fo. *fluviatile*

Common throughout the Interior Highlands; on moist shaded soil, rocks, and decaying wood, often submerged in streams and creeks.

10a(2). *Amblystegium fluviatile* var. *fluviatile* fo. *brevifolium* Moenk.

Uncommon, Boston Mtns., Salem and Springfield Plateaus; on submerged rocks, especially of spring branches.

10b. *Amblystegium fluviatile* var. *orthocladon* (P. Beauv.) Crum, Steere & Anderson

Common throughout the Interior Highlands; on rocks in creeks and streams.

10c. *Amblystegium fluviatile* var. *ovatum* Grout

Uncommon, Boston Mtns., Salem and Springfield Plateaus; on moist rocks along or in creeks and streams.

11. *Amblystegium noterophilum* (Sull. & Lesq.) Holz.

Uncommon, Salem and Springfield Plateaus; on rocks in stream and spring branches.

5. *Platydictya* Berk.

Plants quite small and very slender, irregularly branching, creeping, light to dark green; leaves small, 0.1–0.6 mm, erect-spreading, narrowly triangulate, ovate-lanceolate, to linear-lanceolate, apex acute slenderly acuminate; margins plane, entire or serrulate; costa short or absent; median leaf-cells oblong-hexagonal to rhomboidal, 2–4 : 1, smooth; alar cells usually quadrate but sometimes rectangular, often numerous and extending 5–10 cells up the margin; seta short, about 5 mm long; capsule erect to horizontal, symmetric to curved; peristome double.

a. Plants growing on trees; leaves with a short, single costa .... 2. *P. subtile*
a. Plants growing on rocks; leaves ecostate or nearly so .... b
  b. Leaves usually serrate to denticulate .... 3. *P. jungermannioides*
  b. Leaves, entire or nearly so c
c. Leaves scarcely narrowed to insertion; alar cells rectangular .... 4. *P. minutissimum*
c. Leaves narrowed to insertion; alar cells quadrate .... 1. *P. confervoides*

1. *Platydictya confervoides* (Brid.) Crum

Amblystegiella confervoides (Brid.) Loeske

Common, Boston Mtns., Ozark Hills, Prairie Plains, Salem and Springfield Plateaus; on open to shaded calcareous rocks.

The extreme smallness of this species, leaves usually less than 0.2 mm long, its epilithic habitat, and entire leaves that are narrowed to insertion serve to distinguish it from other species in the Interior Highlands.

2. *Platydictya subtile* (Hedw.) Crum

Amblystegiella subtilis (Brid.) B.S.G.

Uncommon, Boston and Ouachita Mtns., Salem and Springfield Plateaus; on trunks and bases of trees.

This species is the largest of the genus. Leaves may be up to 0.6 mm long, are ovate-lanceolate with a short single costa, and numerous quadrate alar cells.

3. *Platydictya jungermannioides* (Brid.) Crum

Amblystegiella sprucei (Bruch) Loeske

Reported from Conway County, Arkansas, by Moore (1965).

4. *Platydictya minutissimum* (Sull. & Lesq. *ex* Sull.) Crum

Amblystegiella minutissima (Sull. & Lesq.) Nickols

Rare, Boston Mtns., in crevices of moist sandstone.

Crum (1969: 244) concludes that this species deserves recognition because of its small size, linear-lanceolate leaves that are scarcely narrowed to the insertion, and median leaf-cells that are up to 3–6 : 1.

6. *Drepanocladus* (C. Müll.) Roth

1. *Drepanocladus aduncus* (Hedw.) Warnst.

Plants in dark to yellowish green, loosely intertangled mats or dense tufts; stems irregularly to pinnately branched; stem leaves usually secund and often falcate, broadly triangular-ovate, acute to slenderly acuminate, long-lanceolate to filiform-acuminate in aquatic forms; costate to middle of leaf; margins entire; auricles large, decurrent and composed of strongly inflated, usually hyaline cells that may reach the costa; median leaf-cells smooth, linear-flexuose to oblong-hexagonal; branch leaves smaller, different in shape and often more falcate; seta ca. 2.5 cm long; capsules oblong, curved and cernuous.

a. Lower leaf-cells linear .... 1a. *D. aduncus* var. *aduncus*
a. Lower leaf-cells oblong-hexagonal .... 1b. *D. aduncus* var. *polycarpus*

1a. *Drepanocladus aduncus* var. *aduncus*

Uncommon, Salem and Springfield Plateaus; on shaded moist rocks and soil along wet ledges of limestone bluffs or cedar glades.

1b. *Drepanocladus aduncus* var. *polycarpus* (Bland. *ex* Voit) Roth

Uncommon, Salem and Springfield Plateaus; habitats same as var. *aduncus*.

36. BRACHYTHECIACEAE

The following treatment is based, in part, on the recent generic revision of this family by Robinson (1962) and his later taxonomic changes (Robinson, 1965: 319; 1967: 38).

Plants prostrate, branches terete-foliate to complanate-foliate, creeping to ascending or erect and densely caespitose, irregularly to pinnately divided, green to yellowish green; leaves loosely to closely imbricated to julaceous, often heterophyllous, in some taxa plicate, lanceolate, ovate-lanceolate, ovate, to broadly triangular, apex acuminate, acute, short acuminate to obtuse, often twisted, bases often decurrent or cordate-auriculate; margins subserrulate to sharply serrate, often revolute; costa single, well developed, often spinose on back; median leaf-cells elongate, smooth or papillose on back by projecting cell ends; alar cells often numerous, quadrate to rectangular, lax to inflated; seta reddish, elongate, smooth or rough; capsule inclined to rarely erect; peristome double; calyptra cucullate, smooth or rarely hairy.

a. Plants slender and small, often with elongate gemmae or rhizoids present on back of costa, growing on rocks .... 6. *Rhynchostegiella*
a. Plants not slender and small, no gemmae or rhizoids on back of costa; if plants small and slender, leaves abruptly acuminate, and usually growing on trees .... b
  b. Leaves broadly ovate, very concave, cordate-auriculate and clasping the stem .... 5. *Bryoandersonia*
  b. Leaves not broadly ovate, concave, or cordate-auriculate and clasping the stem c
c. Leaves papillose on back by projecting cell ends .... 4. *Bryhnia*
c. Leaves not papillose .... d
  d. Leaves distinctly plicate .... 3. *Brachythecium*
  d. Leaves not distinctly plicate .... e
e. Alar cells usually small and quadrate, never lax or inflated .... f
e. Alar cells lax or inflated .... g
  f. Leaves lanceolate, small quadrate alar cells numerous, sharply serrate from base to apex .... 1. *Homalothecium*
  f. Leaves ovate or ovate-lanceolate, small alar cells not numerous; if leaves lanceolate or quadrate alar cells numerous, not sharply serrate from base to apex .... h
g. Calyptra with hairs; leaves rather abruptly acuminate; median leaf-cells less than 5 times as long as wide .... 2. *Homalotheciella*
g. Calyptra not hairy; leaves not abruptly acuminate; median leaf-cells more than 5 times as long as wide .... h
  h. Branch leaves blunt or acute, tips filled with cells distinctly shorter than median cells, usually sharply serrate .... 7. *Rhynchostegium*
  h. Branch leaves acuminate to long-acuminate, tips not filled with cells distinctly shorter than median leaf cells .... 3. *Brachythecium*

1. *Homalothecium* B.S.G.

1. *Homalothecium leskeoides* (Hook.) Robins.

Palamocladium leskeoides (Hook.) Britt.

Plants robust, irregularly branched, yellowish green; leaves not plicate, lanceolate; margins coarsely serrate; costa extending about ⅔ length of blade; median leaf-cells smooth, linear-fusiform, 6–8 : 1; alar cells quadrate; sporophytes rather erect and unsymmetric.

Rare, southwestern Springfield Plateau; on vertical limestone. Known only from Cherokee Co., Oklahoma, along Terapin Creek near Hwy. 82, Sect. 24, T. 14 N., R. 22 W.

2. *Homalotheciella* (Card.) Broth.

1. *Homalotheciella subcapillata* (Hedw.) Broth.

Plants in thin glossy, yellowish mats, creeping, irregularly to subpinnately branching; leaves not plicate, imbricate, ovate to elliptical-oblong, abruptly acuminate, more or less serrate above, concave; costa extending to middle of leaf or beyond; median cells smooth, linear-fusiform 8–9 : 1; quadrate alar cells numerous, bordering lower ¼ of leaf; capsule sub-erect to nearly horizontal, brown, oblong and slightly curved, swollen on one side; operculum convex-conic, short rostrate; peristome double, teeth 16, brownish yellow to dark red; calyptra cucullate, hairy.

Common throughout the Interior Highlands; on trees or rarely on calcareous rocks.

This species often grows mixed with other corticolous species. When sporophytes are present, the hairy calyptra is distinctive since such a condition is found in only one other corticolous moss in the Interior Highlands, *Forsstroemia*, which is a much more robust plant with julaceous branches.

3. *Brachythecium* B.S.G.

Plants terete-foliate, sometimes prostrate and complanate-foliate; branches often densely caespitose, irregularly to pinnately divided; leaves lanceolate to ovate-lanceolate, acuminate, sometimes plicate and decurrent; margins plane, rarely entire; costa single, from ½–¾ the length of the blade; median leaf-cells fusiform to rhomboid-fusiform, 4–8 : 1 to 8–12 : 1; alar cells small and quadrate to short rectangular, lax or inflated, often forming a distinct area extending from margin to costa; autoicous or dioicous; seta smooth or rough; capsule erect and symmetrical to horizontal and unsymmetrical; peristome double, teeth 16; calyptra cucullate, smooth.

a. Alar cells numerous, quadrate to short-rectangular, forming a distinct triangular area from margin to costa .... 1. *B. acuminatum*
a. Alar cells not as above, lax or inflated, if quadrate to subquadrate, not forming a distinct triangular area from margin to costa .... b
  b. Alar cells, enlarged, lax or inflated c
  b. Alar cells quadrate to subquadrate, little enlarged, not lax or inflated .... f
c. Leaves broadly decurrent; alar cells inflated; plants generally aquatic .... 7. *B. rivulare*
c. Leaves not broadly decurrent; alar cells enlarged, lax, but not inflated; plants not aquatic .... d
  d. Branch leaves plicate .... 2. *B. salebrosum*
  d. Branch leaves not plicate .... e
e. Seta rough; operculum conic; plants generally terete-foliate .... 6. *B. rutabulum*
e. Seta smooth; operculum long rostrate; plants generally complanate-foliate .... 9. *B. serrulatum*
  f. Leaves not plicate .... 8. *B. plumosum*
  f. Leaves plicate .... g
g. Capsule nearly erect .... 3. *B. oxycladon*
g. Capsule inclined to horizontal .... h
  h. Seta minutely roughened; main stem leaves with serrate margins .... 5. *B. campestre*
  h. Seta smooth; stem leaves with margins entire or nearly so .... 4. *B. calcareum*

1. *Brachythecium acuminatum* (Hedw.) Rau & Herv.

Chamberlania acuminatum (Hedw.) Grout

Common throughout the Interior Highlands; on tree bases, logs, and soil around trees.

Two varieties are often recognized. They may be distinguished as follows (Welch, 1957):

a. Stem leaves deeply concave, ovate to ovate-lanceolate; apices acute to short acuminate; median leaf-cells 4–8 : 1 .... *B. acuminatum* var. *cyrtophylla*
a. Stem leaves slightly concave, lanceolate to ovate-lanceolate; apices acuminate; median leaf-cells 5–10 : 1 .... *B. acuminatum* var. *acuminatum*

2. *Brachythecium salebrosum* (Web. & Mohr) B.S.G.

Brachythecium acutum (Mitt.) Sull.
Chamberlania salebrosa (Web. & Mohr) Robins.

Common throughout the Interior Highlands; on rocks or thin soil over rocks.

Robinson (1962) considers *Brachythecium acutum* to be only a variation of *B. salebrosum* with non-plicate leaves.

3. *Brachythecium oxycladon* (Brid.) Jaeg. & Sauerb.

Chamberlania oxyclada (Brid.) Robins.

Very common throughout the Interior Highlands; on various types of substrate from thin soil over rocks to open rocky soil or in pastures.

4. *Brachythecium calcareum* Kindb.

Brachythecium flexicaule Ren. & Card.
Chamberlania calcarea (Kindb.) Robins.

Uncommon throughout the Interior Highlands; on soil, particularly around the bases of trees.

This species is distinctive in that it has both mostly entire leaves and a smooth seta.

5. *Brachythecium campestre* (C. Müll.) B.S.G.

Chamberlania campestris (B.S.G.) Robins.

Reported from Hot Springs, Garland County, Arkansas, in the Ouachita Mtns., by Scully (1941).

6. *Brachythecium rutabulum* (Hedw.) B.S.G.

Uncommon throughout the Interior Highlands; on shaded soil.

This species differs from *Brachythecium serrulatum* by usually being terete-foliate and having a rough seta and rostrate operculum. Robinson (1962) feels that gametophytic characters are unreliable and consequently sterile plants cannot be determined with certainty. Consequently, when sterile plants that are complanate-foliate are assigned to *B. serrulatum* and terete-foliate plants to *B. rutabulum*, the chance for error is obviously great.

7. *Brachythecium rivulare* B.S.G.

Common throughout the Interior Highlands; on logs or rocks in aquatic habitats. Often very abundant in spring branches.

The strikingly decurrent leaves with alar cell both inflated and with thick, often porous walls sets this species apart from all other *Brachythecia* in the Interior Highlands.

8. *Brachythecium plumosum* (Hedw.) B.S.G.

Brachythecium flagellare (Hedw.) Jenn.

Uncommon throughout the Interior Highlands; on thin soils overlying acidic rocks.

9. *Brachythecium serrulatum* (Hedw.) Robins.

Eurhynchium serrulatum (Hedw.) Kindb.
Rhynchostegium serrulatum (Hedw.) Jaeg. & Sauerb.

Very common throughout the Interior Highlands; on open to shaded soil and rocks.

Easily confused with *Brachythecium rutabulum* (see discussion under that species).

4. *Bryhnia* Kaur.

Plants slender, in prostrate mats, bright green, pale green to yellowish green, irregularly divided; branches erect-ascending, terete-foliate, often subjulaceous; leaves of branches loosely imbricate when dry, erect-spreading when moist, ovate, broadly ovate to ovate-lanceolate, decurrent, apex acuminate, sometimes twisted; margins serrulate to sharply serrate; costa extending to near middle of leaf, often ending in spine on back; median leaf-cells oblong-hexagonal to linear-oblong and flexuose, 4–8 : 1, papillose on back by angles of cell wall; alar cells slightly enlarged; seta 8–15 mm long, red, very rough; capsule cernuous to horizontal, oval to oblong-cylindric; operculum conic; peristome double, teeth 16.

a. Branch leaves broadly to ovate-lanceolate, broadly decurrent, apices twisted one-half turn to right; costa not ending in a well developed spine; papillae often obscure .... 1. *B. novae-angliae*
a. Branch leaves narrowly ovate-lanceolate, narrowly decurrent, apices not twisted; costa ending in a well developed spine; strongly papillose .... 2. *B. graminicolor*

1. *Bryhnia novae-angliae* (Sull. & Lesq. *ex* Sull.) Grout

Rare, Ozark Hills, eastern Salem Plateau, Springfield Plateau; on moist shaded sandstone.

2. *Bryhnia graminicolor* (Brid.) Grout var. *graminicolor*

Common throughout the Interior Highlands; on soil and rocks in moist shaded areas.

Bryhnia graminicolor var. *holzingeri* (Ren. & Card.) Grout has been reported from the Salem and Springfield Plateaus by Gier (1955*a*: 32). It may be separated from var. *graminicolor* by its more densely caespitose, shorter branches with leaves that are broader and shorter acuminate. This is probably not a good variety.

5. *Bryoandersonia* Robins.

1. *Bryoandersonia illecebra* (Hedw.) Robins.

Cirriphyllum boscii (Schwaegr.) Grout
Cirriphyllum illecebrum (Hedw.) L. Koch

Plants creeping or with julaceous branches in erect, dense tufts, robust, light to golden or brownish green; leaves closely imbricate, concave, broadly ovate, cordate-auriculate bases clasping the stem, short-acuminate apexes, often twisted; costa extending ⅓–⅔ the length of leaf; median leaf-cells linear, 10–15 : 1; basal cells shorter, often strongly porose; seta elongate; capsule inclined, oval to oblong-oval; operculum long-rostrate; peristome double; calyptra cucullate.

Very common throughout the Interior Highlands; on open to shaded dry rocky soil to moist, shaded rock ledges, and soil banks. Frequently very abundant with mats covering large areas.

6. *Rhynchostegiella* (B.S.G.) Limpr.

1. *Rhynchostegiella compacta* (C. Müll.) Loeske subsp. *compacta*

Amblystegium compactum (C. Müll.) Aust.

Plants small and slender in yellowish green, dense tufts; stems irregularly branching, radiculose, rhizoids often minutely scabrous; leaves erect-open, narrowly decurrent, ovate-lanceolate, ca. 1 mm long, lanceolate and smaller on branches, gradually and evenly acuminate; margins finely denticulate, teeth at base frequently recurved or double by the protruding angles of two adjacent cells; costa percurrent, frequently with rhizoids or delicate elongated gemmae present on back; leaf-cells linear-rhomboidal, thin-walled, 4–10:1; basal cells shortly rectangular to quadrate; seta 1–3 cm long; capsule oblong, erect or nearly so; symmetric, operculum conic-apiculate; peristome double.

Uncommon, Ozark Hills and Salem Plateau; on shaded, moist limestone or sandstone, usually forming extensive loose mats.

Robinson (1965: 318) does not agree with the placement of this species in the genus *Rhynchostegiella*, but retains it in the genus *Amblystegium*.

7. *Rhynchostegium* B.S.G.
(*sensu* Robinson, Bryologist 70:38. 1967)

Plants with irregularly divided branches erect to ascending from prostrate stems, dark green to yellowish green, often slightly glossy; branch leaves loosely to closely imbricate, often dimorphic, sometimes slightly plicate, broadly triangular to orbicular, apex acute in stem leaves, obtuse in branch leaves, leaf bases not to slightly decurrent; margins plane, serrate; costate from ½ to more than ¾ the length; median cells 5–15 : 1, linear-oblong; apical cells distinctly shorter; capsules inclined to horizontal, ovoid to oblong-cylindric; operculum long-rostrate; peristome double.

a. Plants aquatic or subaquatic, robust, stems woody or wiry; seta smooth ___ 3. *R. riparioides*
a. Plants not aquatic, not robust, stems not woody or wiry; seta rough or smooth ___ b
  b. Seta rough; branch leaves broadest ⅓ above base; stem leaves obtusely acute, not decurrent ___ 2. *R. hians*
  b. Seta smooth; branch leaves broadest at base; stem leaves acuminate, slightly decurrent ___ 1. *R. pulchellum*

1. *Rhynchostegium pulchellum* (Hedw.) Robins.

Eurhynchium pulchellum (Hedw.) Jenn.

Two varieties are present in the Interior Highlands and may be separated as follows:

a. Branch leaves loosely imbricate; branch ends attenuate _ 1a. *R. pulchellum* var. *pulchellum*
a. Branch leaves closely imbricate; branches julaceous, ends blunt ___ 1b. *R. pulchellum* var. *praecox*

1a. *Rhynchostegium pulchellum* var. *pulchellum*

Common throughout the Interior Highlands; on shaded soil and rocks. Occasionally on tree trunks and bases.

1b. *Rhynchostegium pulchellum* var. *praecox* (Hedw.) Dix.

Very common throughout the Interior Highlands; on open to shaded soil, rocks, and tree bases.

Crum, Steere, and Anderson (1965: 421) consider this variety merely a form.

2. *Rhynchostegium hians* (Hedw.) Delogn.

Eurhynchium hians (Hedw.) Sande Lac.
Oxyrhynchium hians (Hedw.) Jenn.

Common throughout the Interior Highlands; on moist soil, rocks, and logs.

3. *Rhynchostegium riparioides* (Hedw.) Card. *in* Tourret

Eurhynchium rusciforme Milde.
Oxyrhynchium riparioides (Hedw.) Jenn.

Common, Boston Mtns., Salem and Springfield Plateaus; on wet or submerged rocks in stream and spring branches. Often very abundant.

37. ENTODONTACEAE

The genera included here in this family are those included by Brotherus in the 2nd edition of *Die natürlichen Pflanzenfamilien* (1925), a procedure also adopted by Crum, Steere, and Anderson (1965: 395–396).

Plants slender to moderately large, in loose to dense, glossy, yellowish green to dark green mats, sparingly to subpinnately branched, prostrate to suberect; leaves loosely imbricate, julaceous, to strongly complanate-foliate, concave, oblong-ovate, ovate, to obovate with acuminate, apiculate, to rounded or obtuse tips, gradually narrowed to base, sometimes slightly decurrent; margins plane to narrowly recurved near base and strongly infolded near apex, entire to denticulate above; costa absent or short and double; median leaf-cells smooth or papillose by projecting cell ends, linear to narrowly rhomboidal; apical cells shorter; basal cells numerous in several rows, quadrate to subrectangular; alar cells often enlarged and colored; capsule subcylindric, arcuate and cernuous to cylindric and erect; peristome double, teeth 16; propagula present in *Pterigynandrum*.

a. Stems red; leaves strongly infolded near apex .... 3. *Pleurozium*
a. Stems not red; leaves not strongly infolded near apex .... b
  b. Leaf cells smooth .... 2. *Entodon*
  b. Leaf cells papillose .... 3. *Pterigynandrum*

1. *Pterigynandrum* Hedw.

1. *Pterigynandrum filiforme* Hedw. var. *filiforme*

Plants slender, in thin mats, branches irregularly spaced, often ascending and flagelliform, julaceous, with small, filiform to much branched paraphyllia; leaves obovate to ovate-oblong, obtusely pointed to shortly acuminate or acute, secund or closely appressed when dry; margins slightly denticulate or entire above, reflexed below, slightly decurrent; costa absent or short and double; median leaf-cells papillose by projecting angles, short linear-vermicular to narrowly rhombic, 3–5 : 1; cells of apex broader or shorter; basal cells irregularly quadrate to short-rectangular in 2–8 rows; propagula often present, golden-brown, ovoid, smooth, consisting of 2–3 cells borne on hyaline stalk; capsule erect and usually symmetric.

Reported from Salem and Springfield Plateaus by Gier (1955*a*: 37).

2. *Entodon* C. Müll.

Plants in glossy yellow-green to dark green mats, stems julaceous to complanate-foliate, subpinnately branched; leaves oblong-ovate, oblong-elliptical to oblong- or ovate-lanceolate, abruptly acute, short apiculate to narrowly acuminate, narrowed to insertion, concave; margins entire to denticulate at apex, often narrowly recurved below; costa absent to short and double; median leaf-cells smooth, linear-fusiform to linear-flexuose, 8–15 : 1, cells of apex shorter; basal cells numerous in several rows, quadrate and enlarged; seta red or yellow; capsules erect and cylindric.

a. Leaves narrowly acuminate	1. *E. brevisetus*
a. Leaves acute to apiculate	b
b. Branches julaceous, scarcely complanate-foliate	5. *E. seductrix*
b. Branches complanate-foliate	c
c. Plants slender, branches 1 mm wide or less	3. *E. compressus*
c. Plants moderately robust, branches more than 1 mm wide	d
d. Seta yellow	4. *E. macropodus*
d. Seta reddish brown	2. *E. cladorrhizans*

1. *Entodon brevisetus* (Hook. & Wils. *ex* Wils.) Lindb.

Reported from vicinity of St. Louis by Wilson (1842).

2. *Entodon cladorrhizans* (Hedw.) C. Müll.

Common throughout the Interior Highlands; on shaded rocks, soil, tree bases, and logs.

3. *Entodon compressus* C. Müll.

Entodon challengeri (Par.) Card. (See Mizushima, 1967.)

Uncommon, Prairie Plains, Salem and Springfield Plateaus; on shaded rocks, decaying wood, and tree bases.

The small size and complanate leaves slanting towards the substratum from the middle of the stem and thus resembling the roof of a house distinguish this species from all others in the genus.

4. *Entodon macropodus* (Hedw.) C. Müll.

Entodon drummondii (B.S.G.) Jaeg. & Sauerb.

Common, Boston and Ouachita Mtns., Ozark Hills; on moist shaded noncalcareous rocks, tree bases, and humus.

5. *Entodon seductrix* (Hedw.) C. Müll. var. *seductrix*

Very common throughout the Interior Highlands; on moist shaded rocks, soil, logs, tree bases and trunks.

Entodon seductrix var. *minor* Aust. *ex* Grout has been reported from the Ouachita Mtns. in Garland County, Arkansas, by Scully (1941). This is apparently a poorly segregated variety that is much smaller than var. *seductrix*.

3. *Pleurozium* Mitt.

1. *Pleurozium schreberi* (Brid.) Mitt. var. *schreberi*

Calliergonella schreberi (B.S.G.) Grout

Plants in large, loose, shining yellow-green mats, stems red, rather closely pinnate to irregularly branched, branches terete, loosely julaceous; leaves elliptic or oblong-ovate; margins entire or crenulate-serrate above, strongly infolded above, reflexed below, apex rounded-obtuse; costa faint, short and double or lacking; median leaf-cells smooth, linear-flexuose, 8–15 : 1; apical cells shorter; basal cells short, broader, incrassate and porose, often colored; alar cells enlarged, subrectangular and often colored, forming a triangular patch; capsule subcylindric, arcuate, and cernuous.

Uncommon throughout the Interior Highlands; on moist, shaded rocks and soil, especially of stream banks. Often forming mats that cover extensive areas.

A striking species that may be easily recognized by its large yellow-green loose mats and its red stem.

38. PLAGIOTHECIACEAE

This treatment of this family essentially follows the recent revision of the genus *Plagiothecium* by Ireland (1969*b*).

Plants small to medium in size, irregularly to sparingly branched, prostrate; pseudoparaphyllia present or absent; leaves erect-spreading, imbricate, complanate, though sometimes julaceous, ovate, oblong-ovate, or triangular, straight or secund, acute to acuminate, rarely obtuse, bases not to strongly decurrent; margins plane or narrowly recurved, entire to serrate; costa short, double, or absent; median leaf-cells smooth or dorsally papillose, shortly elliptic, rhomboid-elongate, elongate-linear, to linear-flexuose; alar cells quadrate to rectangular, incrassate or thin walled and enlarged; capsule cylindric, mostly inclined and asymmetric, contracted below mouth when dry; operculum conic to long-rostrate; peristome double, teeth 16.

a. Leaves decurrent .... 1. *Plagiothecium*
a. Leaves not decurrent .... b
  b. Pseudoparaphyllia present, leaf-like .... 3. *Taxiphyllum*
  b. Pseudoparaphyllia absent; if present, filamentous .... 2. *Isopterygium*

1. *Plagiothecium* B.S.G.

Plants medium in size, dull to glossy green, in loose mats; pseudoparaphyllia absent; stems complanate-foliate or julaceous, irregularly branched; leaves imbricate, oblong-ovate, ovate, acute or slenderly acuminate; margins plane or recurved near apex, entire or serrate near apex; costa short and double; median leaf-cells smooth, linear to linear-rhomboidal; alar cells oval, quadrate to rectangular, forming a decurrent region auriculate oval to triangular in outline; brood bodies consisting of 2–7 cells often present; capsule erect to inclined, straight or arcuate; operculum rostrate.

a. Plants usually julaceous with symmetric, concave leaves, decurrent portion of leaf composed of mostly rectangular cells in 1–5 vertical rows, triangular in outline .... 2. *P. roeseanum*
a. Plants complanate-foliate with asymmetric, flat leaves, decurrent portion of leaf composed of many inflated sphaerical, oval, or elongate cells in 2–8 vertical rows .... 1. *P. denticulatum*

1. *Plagiothecium denticulatum* (Hedw.) B.S.G.

Reported from Jackson Co., Illinois, in the Ozark Hills by Hatcher (1952).

2. *Plagiothecium roeseanum* B.S.G.

Common throughout the Interior Highlands; on thin soil or humus overlying rocks.

2. *Isopterygium* Mitt.

Plants in flat, glossy, dark to light green to yellowish green mats; stems and branches usually complanate-foliate, sparingly and irregularly branched; pseudoparaphyllia lacking or present; leaves imbricate to distant, erect-spreading to secund or squarrose, symmetric or asymmetric, not decurrent, ovate, ovate-lanceolate to oblong-lanceolate, acute but more often acuminate; margins plane or recurved, serrate to entire below or throughout; costa short and double or sometimes lacking; median leaf-cells smooth, linear or linear-flexuose; apical cells often shorter and rhomboidal; alar cells not differentiated or differentiated and forming a small area of quadrate to rectangular cells; propagula usually present; capsule oblong or ovoid, straight or arcuate, inclined to cernuous; operculum conic to short-rostrate.

a. Pseudoparaphyllia present, filamentous, of 1–2 rows of cells; alar cells often over 12 μ wide, marginal row usually quadrate or transversely elongate; asexual reproductive bodies with papillose cells .... 1. *I. tenerum*
a. Pseudoparaphyllia absent; alar cells usually less than 12 μ wide (except in *I. muellerianum*), marginal row rectangular, seldom quadrate; asexual reproductive bodies with smooth cells .... b
  b. Outer layer of stem cells large and thin-walled in cross-section; leaves usually abruptly short-acuminate, entire or minutely serrulate .... 2. *I. muellerianum*
  b. Outer layer of stem cells small and thick-walled in cross section; leaves not abruptly short-acuminate; serrulate to strongly serrate in upper half c
c. Leaves mostly cultriform and undulate; propagula twisted-vermiform with 1–5 teeth at apex .... 3. *I. distichaceum*
c. Leaves rarely cultriform, mostly symmetric, seldom undulate; propagula resembling parent plant but smaller .... 4. *I. elegans*

1. *Isopterygium tenerum* (Sw.) Mitt.

Isopterygium micans (Sw.) Kindb.
Plagiothecium micans (Sw.) Par.
Plagiothecium micans var. *fulvum* (Hook. & Wils.) Par.

Common throughout the Interior Highlands; on decaying logs and stumps, tree bases, sandy soil, less rarely on rocks.

2. *Isopterygium muellerianum* (Schimp.) Jaeg. & Sauerb.

Plagiothecium muellerianum Schimp.

Rare, Boston Mtns., eastern Salem Plateau, Ozark Hills; on moist shaded noncalcareous rock crevices and ledges.

3. *Isopterygium distichaceum* (Mitt.) Jaeg. & Sauerb.

Plagiothecium subfalcatum Aust.

Rare, Boston Mtns., eastern Salem Plateau, Ozark Hills; on moist, shaded sandstone or humus, in crevices or on ledges.

Closely related to and considered a variety of the next species by some authors.

4. *Isopterygium elegans* (Brid.) Lindb.

Isopterygium borrerianum (C. Müll.) Lindb.
Plagiothecium elegans (Brid.) Schimp.

Common, Boston and Ouachita Mtns., Prairie Plains, Ozark Hills, and eastern Salem Plateau; on shaded, moist noncalcareous rocks, tree bases and humus.

3. *Taxiphyllum* Fleisch.

Plants in glossy, dark to golden green mats; stems branched, often sparingly, complanate-foliate; pseudophyllia always present, large, foliate; leaves appressed-imbricate, close or distant, appearing distichous, symmetric to somewhat asymmetric, smooth or plicate, broadly ovate to ovate- or oblong-lanceolate, acuminate or abruptly narrowed to an acute, filiform, or rarely subobtuse apex; margins plane or narrowly recurved, serrulate to strongly serrate above; costa lacking or short and double; median leaf-cells smooth or papillose dorsally by projecting cell ends, linear-flexuose; apical cells shorter and rhomboidal; alar cells quadrate to short rectangular in 1– several rows with 1–8 in marginal row; capsule oblong or ovoid, cernuous, straight or arcuate; operculum obliquely rostrate.

a. Leaves usually close, appressed-imbricate; median leaf-cells smooth ...... 1. *T. deplanatum*
a. Leaves distant, not appressed-imbricate; median leaf-cells often papillose .. 2. *T. taxirameum*

1. *Taxiphyllum deplanatum* (C. Müll.) Fleisch.

Isopterygium deplanatum (C. Müll.) Mitt.
Plagiothecium deplanatum (C. Müll.) Spruce

Common throughout the Interior Highland except for the Ouachita Mtns.; on shaded calcareous rocks and soil, occasionally on bases of trees and rotten logs.

2. *Taxiphyllum taxirameum* (Mitt.) Fleisch.

Isopterygium geophilum (Aust.) Jaeg. & Sauerb.
Isopterygium taxirameum (Mitt.) Jaeg. & Saeurb.
Plagiothecium geophilum (Aust.) Grout
Taxiphyllum geophilum (Aust.) Fleisch.

Very common throughout the Interior Highlands; on shaded rocks or soil.

39. SEMATOPHYLLACEAE

Plants slender to moderately large, creeping; branches prostrate to erect and curved, irregular to subpinnate; paraphyllia absent or present; leaves erect-spreading to almost julaceus or complanate, often secund to falcate-secund, ovate-lanceolate to narrowly oblong-lanceolate, slenderly acuminate to short-acuminate; margins plane or revolute below, entire to serrate; costa short and double or absent; median leaf-cells smooth, linear-flexuose, long-rhomboidal or fusiform; alar cells quadrate to rectangular with 2–several large, pellucid, hyaline or colored cells conspicuous at basal angles; capsule erect and symmetric to more or less inclined and asymmetric; operculum rostrate; peristome double, teeth 16.

a. Leaves distinctly serrate above .... 2. *Brotherella*
a. Leaves entire .... b
  b. Paraphyllia large and multiform .... 1. *Callicladium*
  b. Paraphyllia absent .... 3. *Sematophyllum*

1. *Callicladium* Crum

1. *Callicladium haldanianum* (Grev.) Crum (1971)

Heterophyllium haldanianum (Grev.) Kindb.

Plants in loose, irregularly branching, dark to brownish green mats; paraphyllia large and multiform; leaves loosely imbricate, ovate- to oblong-lanceolate, narrowed to a short acumination, concave; margins plane and entire; costa short and double or absent; median leaf-cells linear rhomboidal, 12–18 : 1; basal cells rectangular to quadrate, thin-walled, enlarged and inflated near extreme angles, forming distinct auricles; capsule suberect or inclined, somewhat curved.

Rare, Ozark Hills, Prairie Plains, and eastern Salem Plateau; on shaded sandstone.

2. *Brotherella* Loeske *ex* Fleisch.

1. *Brotherella tenuirostris* (Bruch & Schimp. *ex* Sull.) Broth.

Plants in thin, glossy, green- to yellow-green mats; branches slender, creeping, pinnate or nearly so; leaves slightly curved to secund with apices turned ventrally, loosely imbricate when dry, oblong-lanceolate and slenderly acuminate; margins reflexed below and usually sharply serrate above; costa absent or short and double; median leaf-cells broadly linear, 7–10 : 1; basal cells shorter, quadrate to subquadrate with angular cells inflated, hyaline or slightly colored; capsule erect and symmetric.

Uncommon, Boston and Ouachita Mtns., Ozark Hills, Salem Plateau; on shaded moist acidic rocks, decaying logs and tree bases.

This species may be confused with *Hypnum pallescens*, but the presence of distinctly inflated alar cells distinguishes it from that species.

3. *Sematophyllum* Mitt.

Slender to moderately large plants; branches spreading to erect and curved upward, irregular or pinnate, green to yellowish green; leaves often secund, closely imbricate when dry, concave, oblong-lanceolate to oblong-ovate, gradually acuminate to short-acuminate or acute; margins reflexed to plane, entire; costa absent or short and double; median leaf-cells smooth, fusiform to linear-fusiform or linear-flexuose, 6–12 : 1; apical cells shorter; alar cells oblong to rectangular, often incrassate and colored with 2–6 inflated and enlarged cells at the basal angles; capsule oblong, erect and symmetric to curved and asymmetric, contracted below mouth when dry; operculum rostrate.

a. Plants growing on bark of trees; capsule erect and symmetric .... 1. *S. adnatum*
a. Plants growing on rocks; capsule inclined and asymmetric .... b
  b. Plants moderately large; leaves 1.2–1.8 mm long; median leaf-cells 8–12 : 1 .... 3. *S. marylandicum*
  b. Plants slender; leaves averaging less than 1.2 mm long; median leaf cells 6–8 : 1 .... 2. *S. carolinianum*

1. *Sematophyllum adnatum* (Michx.) Britt.

Uncommon, Boston and Ouachita Mtns., Prairie Plains, Salem and Springfield Plateaus; on decaying logs and tree bases.

2. *Sematophyllum carolinianum* (C. Müll.) Britt. var. *carolinianum*

Common throughout the Interior Highlands; on moist shaded acidic rocks, occasionally on calcareous rocks.

3. *Sematophyllum marylandicum* (C. Müll.) Britt.

Rare, Ouachita Mtns., Ozark Hills, eastern Salem Plateau; on moist shaded norvaculite and sandstone.

40. HYPNACEAE

Plants usually prostrate, irregularly to regularly pinnate; leaves straight to curved, secund, or falcate-secund, concave, ovate-lanceolate to triangular, erect-spreading, apex acuminate, bases cordate, slightly oriculate or ovate; margins entire to serrate or dentate; costa short and double or absent; median leaf-cells smooth or rarely slightly papillose on back, narrow to elongate-elliptic or fusiform, 4–8 : 1; basal cells short-rectangular to quadrate, incrassate, sometimes slightly inflated, often very numerous and extending up margin 8–10 rows, hyaline or colored; seta tall; capsule asymmetric and curved or symmetric and straight; operculum conic to rostrate; peristome double, teeth 16; gemmae rare except in *Platygyrium*.

a. Leaves sharply serrate from base to apex .... 5. *Ctenidium*
a. Leaves entire or only slightly denticulate or serrulate, mostly in upper part .... b
  b. Most leaves clearly curved, sometimes falcate or secund .... 4. *Hypnum*
  b. Most leaves straight with only terminal branch leaves being curved or secund c

c. Terminal branch leaves secund; plants usually growing on tree trunks; capsule erect and symmetric .... 2. *Pylaisiella*
c. Terminal branch leaves not secund; plants growing on rocks or tree trunks and logs; capsule straight or curved .... d
  d. Numerous small deciduous branchlets in clusters in upper leaf axils; leaf-margin narrowly recurved; median leaf-cells 8 : 1; capsule straight and symmetric; usually growing on trees or decaying wood .... 1. *Platygyrium*
  d. Small deciduous branchlets absent; leaf-margins plane; median leaf-cells 4–8 : 1; capsule curved and asymmetric; usually growing on rocks .... 3. *Homomallium*

1. *Platygyrium* B.S.G.

1. *Platygyrium repens* (Brid.) B.S.G. var. *repens*

Plants glossy, usually dark green, in prostrate mats; leaves erect-spreading to loosely imbricate, oblong-ovate to oblong-lanceolate, acute to acuminate; margins entire, narrowly revolute; costa absent or short and double; median leaf-cells smooth, elongate, elliptic to linear-rhomboidal 8 : 1; apical cells rhomboidal; basal cells quadrate, numerous, extending up margin of leaf for 8–10 rows; seta 1–2 cm long; capsule erect, ovate-cylindric, symmetric, gemmae, shaped like small deciduous branchlets, abundant in upper leaf axils.

Very common throughout the Interior Highlands; on decaying tree trunks, stumps, occasionally on acidic rocks.

This species is not likely to be confused with other species, especially when gemmae are present, which is almost always the case. When it grows on rocks it may be confused with *Homomallium adnatum*, particularly if gemmae are few and not well developed. It differs from *H. adnatum* species in that its median leaf-cells are 8 : 1 and its capsule is erect or nearly erect and symmetrical. In *H. adnatum* the median leaf-cells are 4–8 : 1 and the capsule is inclined and asymmetrical.

2. *Pylaisiella* Kindb.

Plants glossy, green to yellow-green, growing creeping over substrate, branching pinnately; branches erect or ascending, strongly recurved at tips because of secund apical leaves; leaves ovate-lanceolate, long-acuminate, entire or nearly so; margins plane or involute; costa absent or short and double; median leaf-cells linear-fusiform, 7–12 : 1, alar cells numerous, quadrate, extending up margin for up to 20 rows; seta 1–2 cm long; capsule erect and symmetrical, oval to oblong-cylindric; peristome double.

a. Segments of inner peristome longer than and only partially adherent to teeth; quadrate alar cells numerous, extending to 15–20 rows along margin .... 1. *P. selwynii*
a. Segments of inner peristome about same length as and wholly adherent to teeth; quadrate alar cells fewer, extending only to about 10 rows along margin .... 2. *P. intricata*

1. *Pylaisiella selwynii* (Kindb.) Crum, Steere & Anderson

Pylaisia selwynii Kindb.

Very common throughout the Interior Highlands; on tree trunks, decaying stumps and logs, rarely on sandstone.

2. *Pylaisiella intricata* (Hedw.) Grout

Pylaisia intricata (Hedw.) Schimp.

Reported from Prairie Plains and eastern Salem Plateau by Gier (1955*a*: 37).

3. *Homomallium* (Schimp.) Loeske

1. *Homomallium adnatum* (Hedw.) Broth.

Plants in dark to light green, closely adherent patches with irregular, short, erect branches; leaves crowded, loosely appressed when dry, concave, ovate to oblong-ovate, abruptly short-acuminate; margins plane and entire; costa short and double or rarely single, often absent; median leaf-cells, smooth, short, linear-hexagonal to subrhomboidal, 4–8:1; alar cell quadrate, numerous, often extending up ⅓ length of leaf on margin; seta 0.5–1.0 cm long, purplish below; capsule oblong to oblong-cylindric, inclined and asymmetric; operculum conic to long-conic and apiculate; peristome double, teeth 16.

Very common throughout the Interior Highlands; on boulders and small stones in shaded places, occasionally on tree bases.

May be confused with *Platygyrium repens.* See notes under that species.

4. *Hypnum* Hedw.

Plants prostrate, light yellow, green, to brownish green, loosely to closely pinnately branched; paraphyllia often present; leaves concave, ovate-lanceolate, decurrent, acuminate to a long, fine point, almost straight, secund, to falcate-secund, often slightly complanate; margins plane, smooth to denticulate; costa short and double; median leaf-cells linear-flexuose, smooth; alar cells distinct, small and quadrate to inflated and hyaline; capsule asymmetric, inclined to horizontal, oblong to cylindric; peristome double, teeth 16.

a. Stems surrounded by thin-walled, hyaline cells; alar cells conspicuously inflated .... 5. *H. lindbergii*
a. Stems surrounded by incrassate cells; alar cells not to only slightly inflated .... b
  b. Quadrate to short-rectangular alar cells numerous, 6–10 in the marginal row c
  b. Quadrate to short-rectangular alar cells few, 4–6 along margin, inflated cells often present, alar group distinct, often colored .... d
c. Leaf margins entire .... 2. *H. cupressiforme* var. *resupinatum*
c. Leaf margins serrate .... 4. *H. pallescens*
  d. Leaves usually abruptly narrowed to a subcordate to cordate base; paraphyllia few; capsule curved, plicate when dry and empty .... 3. *H. curvifolium*
  d. Leaves usually tapering to insertion; paraphyllia numerous, broad, often ciliate; capsules suberect, not plicate when dry and empty .... 1. *H. imponens*

1. *Hypnum imponens* Hedw.

Uncommon, Boston Mtns., Prairie Plains, Salem Plateau; on sandstone of shaded habitats.

2. *Hypnum cupressiforme* Hedw. var. *resupinatum* (Wils.) Schimp.

Common, Boston and Ouachita Mtns.; on shaded, vertical norvaculite and sandstone rocks, sometimes on rock ledges.

3. *Hypnum curvifolium* Hedw.

Common throughout the Interior Highlands; on shaded, rocky soil, rock ledges, and logs. Often extremely abundant and forming extensive mats.

4. *Hypnum pallescens* (Hedw.) P. Beauv.

(Includes *Hypnum reptile* Michx.)

Uncommon, Salem Plateau; on shaded, decaying logs and sandstone. Also reported from McCurtain Co., Oklahoma, in the Ouachita Mtns., by Sharp (1930). This species may be confused with *Brotherella tenuirostris* (see remarks under that species).

5. *Hypnum lindbergii* Mitt. var. *lindbergii*

Hypnum arcuatum Lindb.
Hypnum patientiae Lindb.

Very common throughout the Interior Highlands; on shaded to open rocks, soil, and decaying wood beside creeks and streams.

Hypnum lindbergii var. *demissum* (Schimp.) Loeske has been reported from the Salem Plateau by Gier (1955*a*: 36). This seems to be a poorly distinguished variety separated from var. *lindbergii* by being in thin, light to yellow-green mats.

5. *Ctenidium* (Schimp.) Mitt.

1. *Ctenidium molluscum* (Hedw.) Mitt.

Hypnum molluscum Hedw.

Plants regularly pinnate and plumose, golden-green to yellowish, to occasionally bright-green; leaves crowded, when dry falcate-secund, plicate, slenderly acuminate from an auriculate, cordate-triangular base; margins plane, serrate or dentate; costa short, double, or absent; median leaf-cells linear, 8–12 : 1, slightly papillose at upper ends of cells on back of leaf; alar cells shorter, quadrate-rectangular, not inflated or colored; seta smooth, 1–2 cm long, capsule ovate, curved, inclined to horizontal.

Common throughout the Interior Highlands; on shaded rocky soil, especially of steep slopes and ridges. Occasionally on tree bases.

41. RHYTIDIACEAE

Large, robust, irregularly to sparcely divided plants in loose, intertangled, yellow- to gray-green mats; stems to 15 cm or more long with pseudoparaphyllia sparingly found in branch axils; leaves crowded on stem, imbricate, often strongly secund, to squarrose-spreading, ovate-lanceolate to triangularly cordate, slenderly acute to acuminate, plicate, often rugose; margins sharply dentate to denticulate and revolute; costa single or double; median leaf-cells linear, smooth or papillose; alar cells rounded-quadrate and numerous to few and hexagonal-oblong; sporophytes not known in material from Interior Highlands.

a. Leaves secund and strongly rugose; costa single .... 1. *Rhytidium*
a. Leaves spreading to squarrose, plicate, but not rugose; costa double .... 2. *Rhytidiadelphus*

1. *Rhytidium* (Sull.) Kindb.

1. *Rhytidium rugosum* (Hedw.) Lindb.

Large, robust plants; leaves crowded-imbricate, ovate-lanceolate, strongly rugose and secund; costa single reaching middle of leaf or beyond; median leaf-cells linear; basal cells rounded quadrate, numerous.

Rare, central Salem Plateau; on open to shaded rocky soil near edges of high, north-facing bluffs along Jacks Fork River in Texas and Shannon Counties, Missouri.

2. *Rhytidiadelphus* (Lindb.) Warnst.

1. *Rhytidiadelphus triquetrus* (Hedw.) Warnst. var. *triquetrus*

Large, robust plants; leaves widely spreading to squarrose, cordate-triangular, plicate; margins sharply dentate above, denticulate below; costa double; median leaf-cells linear, spinose-papillose on back by projecting cell angles; basal cells hexagonal-oblong, thick-walled and pitted.

Rare, central Salem Plateau and Boston Mtns.; on open to shaded rocky soil along edges of high, north-facing bluffs or rarely on shaded soil, bases of bluffs.

42. DIPHYSCIACEAE

1. *Diphyscium* Mohr

1. *Diphyscium foliosum* (Hedw.) Mohr

Small, dark green plants in large dense mats; leaves crisped when dry, lingulate, obtuse; costa broad and flattened, often indistinct, ending below apex; upper leaf-cells obscure, rounded-quadrate, strongly papillose on both surfaces; lower leaf-cells rectangular, hyaline and smooth; perichaetial leaves large, ovate-lanceolate, costa ending in a long setaeous point; capsule sessile, shorter than awns of perichaetial leaves, resembling a grain of wheat, golden brown when mature; peristome double, outer rudimentary or lacking, inner whitish, 16-plicate.

Common throughout the Interior Highlands; on shaded, rocky soil, vertical rock exposures, and undersides of overhanging ledges, particularly sandstone.

43. POLYTRICHACEAE

Plants erect, small to robust, growing in green to brownish or reddish green, open, short to tall tufts; leaves stiff, coarse, with or without a sheathing base, lamellae usually present on upper surface of costa; capsule erect to inclined, terete or angled, exserted; peristome of 32 or 64 short teeth attached by their tips to a thin membrane.

a. Leaves with 0–8 rows of lamellae, bordered by a row of elongated cells, without a sheathing base; capsule terete, peristome of 32 teeth; calyptra smooth .... 1. *Atrichum*
a. Leaves with 10–70 rows of lamellae, not bordered by a row of elongated cells, sheathing base present; capsule terete or angled, peristome of 32 or 64 teeth; calyptra hairy .... b
  b. Plants small, 2–8 mm tall, forming open, short tufts; leaves 3–4 mm long; capsule terete; peristome of 32 teeth .... 2. *Pogonatum*

b. Plants large, 2–20 cm tall, usually forming dense tall tufts; leaves 2–12 mm long; capsule angled; peristome of 64 teeth .... 3. *Polytrichum*

1. *Atrichum* P. Beauv.

Plants erect, small to robust, forming green to brownish green tufts; leaves ovate to lingulate or lanceolate, lamellae few (0–8); margins distinctly bordered by elongated cells; capsules erect to inclined, elongated, terete; peristome of 32 teeth; calyptra smooth.

a. Leaves elliptical to obovate, lamellae 0–3 cells high .... 1. *A. crispum*
a. Leaves lingulate to lanceolate, lamellae 2–14 cells high .... b
  b. Leaves 1–1.3 mm wide, lingulate, lamellae obscuring $\frac{1}{5}$ or less of the leaf width at the midpoint of leaf length .... 2. *A. undulatum*
  b. Leaves 0.5–1.0 mm wide, linear-lanceolate, lamellae obscuring $\frac{1}{4}$–$\frac{2}{3}$ of the leaf width at the midpoint of leaf length .... 2. *A. angustatum*

1. *Atrichum crispum* (James) Sull. & Lesq. var. *crispum*

Rare, Boston Mtns., Salem Plateau; on soil banks of ditches and gullies.

2. *Atrichum undulatum* (Hedw.) P. Beauv.

This species is generally very robust with leaves that are strongly crispate when dry and markedly undulate when moist. Three varieties are represented in the Interior Highlands and may be separated as follows:

a. Lamellae obscuring $\frac{1}{7}$–$\frac{1}{5}$ of the width of the leaf at midpoint of its length .... 2b. *A. undulatum* var. *minus*
a. Lamellae obscuring $\frac{1}{11}$–$\frac{1}{7}$ of the width of the leaf at midpoint of its length .... b
  b. Lamellae 6, 2–6 cells high; plants autoicous .... 2c. *A. undulatum* var. *alte-cristatum*
  b. Lamellae 2–5, rarely 6, 6–8 cells high; plants monoicous .... 2a. *A. undulatum* var. *undulatum*

2a. *Atrichum undulatum* var. *undulatum*

Common and locally abundant throughout the Interior Highlands; on shaded sandy or calcareous soils along gullies, ditches, and, especially, shaded ravines.

2b. *Atrichum undulatum* var. *minus* (Hedw.) Par.

Uncommon, Boston and Ouachita Mtns., Prairie Plains, Salem and Springfield Plateaus; on shaded rocky soil in ravines.

2c. *Atrichum undulatum* var. *alte-cristatum* Ren. & Card.

Reported from the Salem Plateau by Gier (1955*a*: 32). Frye (1949) considers this variety a poor one, not always distinct from *A. undulatum* var. *undulatum*, although Ireland (1969*a*: 363) considers it a distinct species.

3. *Atrichum angustatum* (Brid.) B.S.G. var. *angustatum*

Atrichum xanthopelma (C. Müll.) Jaeg.
Atrichum macmillanii (Holz.) Frye
Atrichum papillosum (Jenn.) Frye

Very common throughout the Interior Highlands; on poor soil of ditches, gullies, lawns, and on bare soil and soil mounds in forests.

Forms with papillose leaves are occasionally encountered. Such forms have been considered as a separate species, *Atrichum xanthopelma*, by Frye (1949). Thomas (1953) considers such papillose forms to be *A. angustatum*, a judgement followed in this treatment.

2. *Pogonatum* P. Beauv.

Plants small, erect, scattered or forming open tufts; green to dark green; leaves lanceolate to lanceolate-subulate from a sheathing base, 3–4 mm long, lamellae 10–35; margins of leaves not bordered by elongated cells; capsules erect, terete; peristome of 32 teeth; calyptra hairy; protonema persistent.

a. Leaves with 10–15 lamellae, serrate in upper half; plants usually scattered .... 1. *P. pensilvanicum*
a. Leaves with 20–70 lamellae, entire; plants usually forming dense tufts .. 2. *P. brachyphyllum*

1. *Pogonatum pensilvanicum* (Hedw.) Par. var. *pensilvanicum*

Pogonatum brevicaule P. Beauv.

Common throughout the Interior Highlands; on shaded, sandy soil banks. Plants usually scattered on a mat of dense, green protonema.

Male plants are usually smaller than the female plants.

2. *Pogonatum brachyphyllum* (Michx.) P. Beauv.

Common throughout the Interior Highlands; on shaded, sandy soil, especially along road cuts and ditches. Plants usually form dense mats.

This species is easily recognized by its short, thick, entire leaves and is usually restricted to soil of weathered dolomite and sandstone.

3. *Polytrichum* Hedw.

Plants usually 2–20 cm tall, forming open to dense tufts; leaves 2–15 mm long, rigid, lanceolate, linear-lanceolate, to linear-subulate; margins entire or toothed, plane or involute; lamellae numerous along upper surface; capsule angled, usually inclined; peristome of 64 teeth; calyptra densely hairy.

a. Leaves entire c
a. Leaves toothed .... b
  b. Terminal cells of lamellae flat, not appearing notched in cross section .... 1. *P. ohioense*
  b. Terminal cells of lamellae notched in cross section .... 2. *P. commune*
c. Awn of leaf reddish .... 3. *P. juniperinum*
c. Awn of leaf white or hyaline .... 4. *P. piliferum*

1. *Polytrichum ohioense* Ren. & Card.

Very common throughout the Interior Highlands; on open to shaded rocky soil of ridges, ledges, rock crevices, and around the edges of glades. In this last area this species often forms dense carpets along the edges of flat rock exposures of both sandstone and limestone where it is interdispersed with equally well-developed colonies of *Leucobryum glaucum*, *Philonotis fontana*, and *Climacium americanum*.

2. *Polytrichum commune* Hedw.

a. Perichaetial leaves distinctly longer than the upper stem leaves, forming an erect tuft about the seta .... 2b. *P. commune* var. *perigoniale*
a. Perichaetial leaves similar to the upper stem leaves, not forming an erect tuft about the seta .... 2a. *P. commune* var. *commune*

2a. *Polytrichum commune* var. *commune*

Common throughout the Interior Highlands; on open soil around the bases of boulders, on rock ledges, or on soil pockets of large flat rock exposures, particularly felsite and granite. Tufts are usually very tall, 10–20 cm.

Small plants may be confused with *P. ohioense*, but may be separated by the features noted in the key to species.

2b. *Polytrichum commune* var. *perigoniale* (Michx.) B.S.G.

Apparently uncommon, Arkansas Valley, Boston Mtns., Salem and Springfield Plateaus; on soil of rocky woodlands, creek banks, and moist rock ledges.

3. *Polytrichum juniperinum* Hedw. var. *juniperinum*

Very common throughout the Interior Highlands; on open, dry soil of oak-hickory and oak-pine forests along ridges, and on thin soil over flat rock exposures of sandstone, granite, and felsite.

4. *Polytrichum piliferum* Hedw.

Rare, Prairie Plains and Springfield Plateau; on thin soil over sandstone, especially along open bluffs. Often mixed with *Polytrichum juniperinum.*

Appendix I

Glossary

Acrocarpous: archegonia located at tip of branch, plants usually, but not always, of erect habit.
Acumen: the slenderly tapering point of leaf.
Acuminate: slender point of leaf that is gradually tapering.
Alar cells: cells at the basal angles of leaves.
Annulus: ring of specialized cells between rim of capsule and the operculum.
Antheridium: multicellular male gametangium.
Apiculate: leaf ending in a short, abrupt, sharp point.
Apophysis: swelling of seta just beneath capsule.
Appressed: leaves lying flat on an erect stem.
Archegonium: multicellular female gametangium.
Arcuate: bent like a bow.
Areolation: network formed by cell walls of leaf as seen in surface view.
Aristate: with a bristle-shaped or awn-like point.
Astomous: capsule not opening by a regularly dehiscent lid or operculum.
Attenuate: tapered or long drawn out leaves.
Auriculate: ear-like lobes more or less developed at basal angles of leaves.
Bicostate: leaves having two mid-ribs.
Brood-bodies: vegetative reproductive cells; also called gemmae.
Calcicolous: growing on calcareous substrates.
Calyptra: cap or hood covering capsule, derived from upper portion of archegonium.

CAMPANULATE: calyptras shaped like a bell.
CANALICULATE: leaves channelled in upper portion.
CAPSULE: enlarged spore producing portion of sporophyte.
CARINATE: leaves folded sharply along midrib and thus forming a keel.
CAULESCENT: possessing a stem.
CERNUOUS: capsule drooping, nodding, or slightly inclined.
CAESPITOSE: growing in tufts or mats.
CHLOROPHYLLOSE: containing chloroplasts.
CILIA: delicate hair-like structures between segments of inner peristome.
CIRCINATE: leaves coiled or bent into partial or complete circle.
CLAVATE: club-shaped.
CLEISTOCARPOUS: capsule opening irregularly.
COLLENCHYMATOUS: cell walls thickened at angles or corners.
COMPLANATE: leaves flattened or compressed along stem.
CONDUPLICATE: leaves folded lengthwise along costa.
CONVOLUTE: leaves with rolled margins.
CORDATE: broadest portion of leaf near base.
CRENATE: teeth of leaf rounded or convex.
CRENULATE: leaf margins with small, rounded projections.
CRISPATE: leaves curled or twisted.
CUCULLATE: calyptra hood-like, usually split along one side.
CUNEATE: wedge shaped.
CUSPIDATE: tip of leaf with sharp or rigid point.
DECURRENT: lower margin of leaf extending down the stem below place of attachment.
DEHISCENT: splitting open.
DELTOID: triangular.
DENDROID: tree-like in growth form.
DENTATE: teeth of leaf extending outward.
DENTICULATE: teeth of leaf minute.
DIOICOUS: antheridia and archegonia on separate plants.
DISTICHOUS: leaves arranged on stem in two vertical ranks.
DORSAL: surface of leaf away from stem axis.
ECOSTATE: leaves without costa.
ELLIPTIC: oblong with rounded ends.
ELONGATE: considerably longer than wide.
EMARGINATE: leaf notched at apex.
EMERGENT: capsule extending slightly beyond perichaetial leaves.
ENDOSTOME: inner peristome.
ENTIRE: margin of leaf smooth.
ERECT-ASCENDING: leaves almost erect, extending upwards or forward.
EXCURRENT: costa extending beyond tip of leaf.
EXOSTOME: outer row of peristome.
EXOTHECIAL: outer layer of cells of the capsule wall.
EXSERTED: capsule extending beyond the perichaetial leaves.
FALCATE: leaves curved like a sickle.
FALCATE-SECUND: leaf curved like a sickle and all leaves extending in the same direction or turning to one side of the stem.
FASCICULATE: branches clustered, arranged more or less in bundles.
FIBRILS: spiral thickenings of the walls of hyaline cells in *Sphagnum*.
FILAMENT: thread-like structure.
FIMBRIATE: fringed with cilia.
FLACCID: soft in texture.
FLAGELLIFORM: slender, string-like branchlets.
FLEXUOUS: irregularly wavy.
FOLIOSE: leaf-like.
FRUIT: referring to sporophyte.
FULVOUS: yellow, tawny, or dull brownish yellow.
FUSCOUS: dull brown.
FUSIFORM: spindle-shaped; narrowly oval with narrow, tapering ends.
GEMMA: cell or cluster of cells of gametophyte capable of reproducing the plant vegetatively.

Gemmiform: bud-like.

Geniculate: bent like a knee.

Gibbous: capsule swollen more on one side than another.

Glabrous: smooth, neither hairy or papillose.

Glaucous: bluish-gray or bluish-white; whitened with a bloom.

Globose: rounded like a ball, sphaerical.

Gregarious: plants growing near each other or clustered.

Guard cells: cells surrounding the stoma.

Guide cells: large parenchymatous cells seen in cross-section of costa.

Gymnostomous: failing to produce peristome.

Habit: general appearance or aspect of a plant.

Hair-point: leaf tip which differs from rest of leaf in appearance.

Heteroicous: more than one form of inflorescence in the same species.

Homomallous: leaves or branches all pointing in same direction.

Imbricate: leaves closely overlapping.

Immersed: capsule hidden with perichaetial leaves.

Incrassate: thickened cell-walls.

Inflated: cells of alar region enlarged much beyond size of neighboring cells.

Inflorescence: cluster of antheridia and/or archegonia.

Insertion: attachment of leaves to stem.

Involute: margins of leaves inrolled.

Isodiametric: cells having equal diameter in all directions.

Julaceous: smooth, slender, and cylindrical; leaves uniformly erect or appressed.

Keel: sharp ridge formed by longitudinal folding of leaves.

Laciniate: jagged or torn.

Lamellae: longitudinal strips of tissue in the form of thin blades standing on edge and extending parallel with one another along the costa.

Lamina: blade of leaf.

Lanceolate: shaped like a point, broadest at base and tapering to a point.

Leucocysts: cells without chlorophyll.

Ligulate: strap-shaped.

Linear: very narrow with nearly parallel margins.

Linear-rhomboidal: narrow, somewhat elongate rhomboid.

Lingulate: tongue-shaped.

Lumen: cavity or space within a cell.

Mammillate: operculum with a short point; or large, rounded papilla covering a cell.

Median: pertaining to cells of leaf in the middle between the costa and margins.

Mitrate: calyptra shaped like a peaked cap with margins undivided or with several equal clefts.

Monoicous: antheridia and archegonia on same plant.

Mucro: very short, small, abrupt point, usually stout.

Muticous: not pointed; awnless.

Oblong: elliptic, obtuse at each end, with the length 3–4 times the width.

Obovate: inversely ovate, narrowed towards the base and broadest at the distal end.

Obtuse: blunt or rounded at the apex.

Ochraceous: yellowish-brown.

Operculum: lid covering the mouth of the capsule.

Orbicular: almost circular.

Oval: broadly elliptical.

Ovate: egg shaped with broader end downward.

Panduriform: shape of a fiddle.

Papillae: minute, nipple-shaped, rounded, or acute projections.

Paraphyllia: thread-like structures or minute leaf-like structures growing among the leaves.

Paraphyses: jointed, hyaline hairs or minute threads among the antheridia and archegonia.

Parenchymatous: cells joined with broad ends, walls thin and intercellular spaces often conspicuous.

Paroicous: antheridia and archegonia on same plant but not mixed.

Patulous: leaves spreading from the stem at an angle of 46–90°.

Pellucid: completely or partially transparent.

Pendent: hanging down from its support.

Percurrent: costa extending through the entire leaf, but not beyond.

Perichaetial: leaves that enclose archegonia.
Perigonal: leaves that enclose antheridia.
Peristome: fringe of teeth and segments surrounding the mouth of the capsule.
Peristome perfect: complete with teeth and segments.
Peristome single: consisting of teeth only.
Piliferous: with hair-like projections at tips of leaves.
Pinnate: branches spreading in a feather-like fashion.
Pleurocarpous: archegonia located on a short, lateral branch, plants usually of a creeping habit.
Plicate: folded lengthwise into pleats and furrows.
Plumose: regularly and closely pinnate.
Porose: cell walls perforated by pores.
Procumbent: trailing along the ground.
Propagula: small structures capable of reproducing the plants vegetatively.
Prosenchymatous: narrow cells with ends dove-tailed into each other.
Pseudopodium: leafless, branch-like extension of gametophyte resembling a seta.
Pulvinate: shaped like a cushion.
Pyriform: pear-shaped.
Quadrate: square, or nearly so, in surface view.
Radiculose: covered with rhizoids.
Reflexed: bent backwards.
Reniform: kidney shaped.
Reticulate: forming a net.
Retort cells: enlarged, cuticular cells of branches of *Sphagnum*.
Retuse: shallow notch in a rounded apex.
Revolute: margins rolled backward.
Rhizoids: simple or branched, reddish-brown, multicellular outgrowths of stems and sometimes leaves.
Rosette: terminal leaves so arranged as to resemble a rose.
Rostellate: operculum having a short beak.
Rostrate: operculum having a long beak.
Rupestral: growing on rocks.
Secund: leaves all turned to one side.
Segments: projections of the inner row of peristome.
Serrate: toothed.
Serrulate: minutely serrate.
Sessile: not stalked.
Seta: stalk of sporophyte.
Setaceous: tip of leaf bristle-like.
Sinuate: margin deep-wavy.
Sinuose: cells wavy.
Spatulate: narrowly obovate and attenuate downwards.
Spinose: with small spines.
Squarrose: extending from stem at an angle greater than 45°.
Sterid cells: small, thick-walled cells seen in cross-section of costa.
Strumose: goiter-like on one side.
Subulate: leaves with a very fine point, needle-like or awl-like.
Sulcate: longitudinally grooved capsule.
Synoicous: archegonia and antheridia mingled in same inflorescence.
Teeth: projections of outer peristome.
Terete: cylindrical, round in cross-section.
Tomentose: covered with matted hairs.
Trigones: the thickening in the angles of the cells of leaves.
Triquetrous: sharply three-angled.
Tristichous: arranged in three rows or ranks.
Truncate: ending abruptly.
Tubulose: leaves with strongly inrolled margins that meet.
Tumid: swollen, inflated, or distended.
Turbinate: top-shaped.
Turgid: swollen or inflated.
Uncinate: hook-shaped.

UNDULATE: surface or margin wavy.
UNIPAPILLATE: one papilla per cell.
VAGINANT: sheathing.
VENTRAL: surface of leaf facing the stem when parallel with the axis.
VERMIFORM: worm-shaped.
WHORLED: branches arranged in a ring or circle about stem.
XERIC: dry habitat.

APPENDIX II

INDEX TO FAMILY NUMBERS FOR FAMILIES AND GENERA

The number after each entry is the number of the family or the family in which the genus may be found. Families are indicated in large and small caps, accepted genera in *italic*, and genera cited only as synonyms in roman.

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NOTE ADDED IN PROOF

Monte G. Manuel has discovered that a collection determined as *Cryphaea glomerata* from Pike County, Arkansas, (*Redfearn 20214*) is *Cryphaea ravenelii* Aust. This latter species may be distinguished from *C. glomerata* by its rounded-obtuse leaves and single peristome.—*PLR.*

EDITOR'S NOTE

The moss *Bryoxiphium norvegicum* (Brid.) Mitt. is a rare member of the flora of the Interior Highlands. Julian A. Steyermark first discovered *Bryoxiphium* in the Interior Highlands at Pickle Spring, Ste. Genevieve Co., Missouri, one of the State's most interesting botanical localities, in 1934. This locality, which fortunately remains largely undisturbed, harbors many other interesting plants, both cryptogams and phanerogams.

Askell and Doris Löve's "Studies on *Bryoxiphium*" (The Bryologist 56: 73–94; 183–203. 1953) presents a detailed investigation of the history, taxonomy, and distribution of the genus. Since Steyermark's discovery and the Löves' study, several additional localities for this species have been discovered in the Interior Highlands; these are summarized by Paul L. Redfearn, Jr. in "Mosses of the Interior Highlands of North America" in this issue of the ANNALS.

The illustration of *Bryoxiphium norvegicum* on the cover banner is taken from W. S. Sullivant's plate in his "Contributions to the bryology and hepaticology of North America" (Mem. Amer. Acad. Arts 3: 57–66 + 5 pl. 1848). Sullivant was the first to collect the moss in North America, in Ohio and Kentucky. *Bryoxiphium norvegicum* has never been found in Norway, indeed it is not known from Europe at all. According to the Löves' "Studies," the Dane Axel Mörch first collected it—in Iceland in 1820. Mörch sent his moss collections to the German bryologist C. F. Hornschuch, who apparently determined the specimen as *Weissia volcanica* P. Beauv., a moss of Madagascar and Réunion Island. Hornschuch seems to have wondered if the Icelandic moss could be conspecific with the one known from off eastern Africa and sent some material to Augustin Desvaux in Paris for further study. Desvaux realized that Mörch's collection had been misdetermined and sent the specimen on to S. E. Bridel. Although Desvaux was correct in his determination, he noted on the specimen that it had been collected in Norway. Bridel published the name *Phyllogonium norvegicum* in his *Bryologia Universa* (1827) based on this collection, and Mitten (*Musci Austro-Americani*, 1869) made the combination *Bryoxiphium norvegicum*, the name by which it is known today.—*Editor.*

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